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CORRIGENDA.

Page 76, line 11. **For** *Gnathophyrne* **read** *Gnathophryne.*

Page 178, line 22. **For** *pumilis* **read** *pumilio.*

Page 218, line 7. **For** *Gnathopropsis* **read** *Gnathoprosopis.*

Page 236, line 18. **For** *nirgohirta* **read** *nigrohirta.*

CONTENTS.

No. 1.

Published June 20, 1929.

No. 2.

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No. 3.

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No. 4.

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No. 5.

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CONTRIBUTIONS ON THE PERMO-CARBONIFEROUS AVICULOPECTINIDÆ OF NEW SOUTH WALES.*

By

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with an Introduction by

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(Plates i-xvi and Figures 1-6.)

Introduction.

In 1927 the Australian Museum acquired the collections of Mr. Varney Parkes. This assemblage of fossils, upwards of five thousand specimens, is the result of thirty years' careful and assiduous field work, more particularly in the Illawarra district of New South Wales.

This area has been the subject of considerable geological work which has been recorded by Strzelecki, Dana, W. B. Clarke, T. W. E. David, L. F. Harper, C. F. Laseron, Miss Ida Brown, and others. The specimens described in this paper are from the stage named by David "Nowra grits" in the Upper Marine Series of the Permo Carboniferous, and may be regarded as supplementing the collection in the Mining and Geological Museum, Sydney, that described by John Morris in Strzelecki's "Physical Description of New South Wales and Van Dieman's Land," Dana's collection now preserved at Washington, and Clarke's described by De Koninck and destroyed by fire in 1882.

The collection is particularly rich in Pelecypoda, and the Aviculopectinidae have been selected as the subject of the first paper

* Where not otherwise designated the various specimens are from the Varney Parkes collection.

on account of the wealth of specimens and their generally excellent preservation, taking into consideration the usually unfavourable matrix.

Mr. Fletcher's descriptions may be regarded as supplementary and emendatory of those by Etheridge and Dun, the greater series having enabled him to enlarge the range of variation of certain species and with these points I am in agreement.

Interesting features in the Pecten fauna of the Australian Permo-Carboniferous are the large size of species of Aviculopectens and Deltopectens and the particular development of the last named genus. Its distribution beyond Australia has been recorded by Y. T. Chao,[1] who describes two species of *Deltopecten, giganteus* and *multistriatus*. In speaking of his *giganteus*, a form of large size and very similar to Australian forms, Chao remarks: "excepting the greater convexity of the umbonal region, the surface of this valve (left) is marked essentially by the same kind of sculpture as those of the right valves, a fact very unusual in the genus *Delto pecten*, in which the left valve is generally characterised by more robust surface sculptures."

Deltopecten is separated from *Aviculopecten* by an internal character which is observable only under certain conditions of preservation, hence in many cases the exact generic terminology of many of our Aviculopectinidæ is uncertain. Girty remarks[2]: "there occur a number of forms whose internal structures are unknown and whose generic position with *Aviculopecten,* as against *Pecten, Deltopecten*, and possibly other genera, is as yet to be demon strated." The same author's remarks[3] on *Deltopecten*, with which he makes his *Limipecten* a synonym, are of great interest. From the Caney Shale he describes *Deltopecten* (?) *caneyanus*. From the Moorefield Shale of Arkansas he describes *D. batesvillensis* Weller, and *D. sp.*,[4] and from the Wewooka Formation of Oklahoma, *Deltopecten texanus* Girty, *D. vannleeti* Beede. It is more than probable that further examination will prove the presence of *Deltopecten* in European Carboniferous Permian faunas. The late H. S. Bion records[5] a *Deltopecten* cf. *illawarrensis* from the Kashmir; there is, judging from the description and figures, no evidence as to the generic affinity beyond the surface ornamentation.

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[1] Chao.—Fauna of the Taiyuan Formation of North China—Pelecypoda. Pal. Sinica, (B), ix, 3, 1927, pl. iii, figs. 1-3, pl. iv, figs. 1-3, pl. ii, fig. 22, pl. iii, figs. 4-6, pl. iv, fig. 4.

[2] Girty.—The Guadalupian Fauna. U.S. Geol. Surv., Prof. Pap. 58, 1908, p. 432.

[3] Girty.—The Fauna of the Caney Shale of Oklahoma. U.S. Geol. Survey, Bull. 307, 1909, pp. 30-31.

[4] Girty.—U.S. Geol. Surv, Bull. No. 439, 1911, p. 89, pl. xi, figs. 1-4.

[5] Bion.—Fauna of the Agglomeratic Shale Series of Kashmir. Pal. Indica (n.s.), xii, 1928, p. 36, pl. ii, fig. 9, and pl. iii, fig. 1.

The registration numbers of specimens of Aviculopectinidae figured in Memoirs of the Geological Survey of New South Wales, Palæontology, no. 5, vol. ii, part 1, 1906, are as follow:—

(A). SPECIMENS IN THE MINING AND GEOLOGICAL MUSEUM, SYDNEY.

	Plate.	Figure.	Registered Number.
Aviculopecten englehardti Eth., Jr., and Dun	IX	6	F.2572
	IX	7	F.2603
	IX	8	F.2599
	IX	9	F.2573
	IX	10	F.2571
	IX	11	F.2557
	XIV	6	F.6645
	XIV	7	F.6645
	XIV	8	F.6645
Aviculopecten mitchelli Eth., Jr., and Dun ..	I	3	F.6632
	II	1	F.2615
	I	1-2	F.6643
	X	5	F.6635
	XII	5	F.2578
	XIII	3	F.6641
	XVI	3	—
Aviculopecten ponderosus Eth., Jr., and Dun	V		F.6633
	XII	4	F.2575
Aviculopecten profundus De Koninck .. .	XI	5	F.2606
	XI	4	F.6626
Aviculopecten ptychotis (McCoy)	XV	5	F.1749
	XV	6-7	F.1760
Aviculopecten sprenti Johnston	II	7	F.6649
	II	—	F.2588
	II	6	F.2314
	XII	1	F.6637
	XIII	1	F.6648
	XIII	9	—
	XVI	5-6	—
Aviculopecten squamuliferus (Morris)	I	4	F.2579
	II	4	F.2596
	II	5	F.2614
Aviculopecten tessclatus (Phillips)	XV	5	F.1763
	XV	9	F.6646
Aviculopecten sp. Eth., Jr., and Dun	XV	10	F.4605
	XV	11	F.4553
	XV	12	F.4634
Aviculopecten tenuicollis (Dana)	XIII	10	F.2589
	XIII	11	F.2595
Deltopecten farleyensis Eth., Jr., and Dun ..	XIII	4	F.2587
	VI	2	F.2584
	XIII	5	F.6639
	XIII	6	F.6638
	XVI	4	—

	Plate.	Figure.	Registered Number.
Deltopecten fittoni (Morris)	X	6	—
	VIII	1	F.2617
	VIII	2	F.2620
	VIII	3	F.2619
	XVI	1	F.6315
Deltopecten illawarrensis (Morris)	II	2	F.6628
	II	3	F.6631
Deltopecten leniusculus (Dana)	VII	2	F.6636
	IV	—	F.6644
	III	1	F.2574
	VI	1	F.2575
	VII	1	F.2576
	X	1-2	F.2582
	XI	3	F.3127
Deltopecten limæformis (Morris)	X	4	F.6629
	X	3	F.10861
Deltopecten obliquatus Eth., Jr., and Dun ..	XIII	7	F.2616
Deltopecten subquinquelineatus (McCoy) ..	XIII	2	F.6628
	XIII	8	F.6634
	XII	1-2	F.6640
	IX	2	F.6642
	IX	5	F.2578a
	III	2	F.2622
	LX	1	F.2624
Deltopecten wingenensis Eth., Jr., and Dun	XIV	2	F.5142
	XIV	3-4	F.5143
Deltopecten sp. Eth., Jr., and Dun	IX	12	F.6308
Entolium aviculatum (Swallow)	XV	4	F.6630
	XV	1	F.1777
	XV	2	F.1778
	XV	3	F.1779

(B). Specimens in the Australian Museum.

	Plate.	Figure.	Registered Number.
Aviculopecten squamuliferus (Morris)	VIII	4	F.116
Deltopecten subquinquelineatus (McCoy) ..	IX	3-4	F.14233
Deltopecten limæformis (Morris)	XI	1-2	F.17498

DESCRIPTIONS OF SPECIES.

Aviculopecten squamuliferus (*Morris*).

Pecten squamuliferus **Morris, Strzelecki's Phys. Descript. N. S. Wales, 1845, p. 278, pt. xiv, f. 1.**

? *Aviculopecten multiradiatus* Etheridge, Quart. Journ. Geol. Soc., 1872, xxviii, p. 327, pl. 13, f. 1.

Aviculopecten squamuliferus (Morris), Etheridge, Jr., and Dun, Mem. Geol. Survey of N.S.W., Palæontology, No. 5, Vol. ii, part 1, 1906, p. 8 and figs.

Observations.—The specimens of this species, figured by Etheridge and Dun in their monograph are before me, but there is nothing which can be compared to them in the large Varney Parkes collection.

The original description by Morris has already been discussed by Etheridge and Dun as being "quite insufficient for the recognition of this species, and, were it not for the figure, it would be necessary to relegate the name to the rejectamenta." These authors possessed four examples of convex valves, and they added many details to the description. Apparently the only known specimens of this species are these four convex valves, and the specimen figured by Morris.

The specimens that Etheridge and Dun examined were, according to those authors, four of the convex valves and in the explanation of the plates were called right valves. This is contrary to the usual rule of the Aviculopectens, in that the left valve is usually the more convex of the two. The valves must be regarded as right valves and are slightly convex, so apparently we may assume from this that the unknown left valve is far more convex than the slightly convex right valves, from which apparently descriptions have so far been compiled.

An examination of Morris' figure and Etheridge and Dun's figured specimens prove them to be identical, except the specimen figured on plate 1, figure 4, which in my opinion should be referred to my species *A. largis*.

A great number of specimens closely allied to *A. squamuliferus* is contained in the collection, and these fall into distinct types according both to ornamentation and size, but none of them can be placed with the above species. A glance at the localities from which the specimens of *A. squamuliferus* were collected, proves the species to be characteristic of the Lower Marine Series of the Permo-Carboniferous. Its absence in the Varney Parkes collection is therefore not surprising, as the majority of the specimens were collected from the Upper Marine Series of the South Coast of New South Wales.

Further details are added to Etheridge and Dun's description in order to prevent confusion with several closely allied new species.

Description.—Right or flat valve as wide as long; inequilateral and considerably depressed, only slightly swollen in the umbonal

region. Dorsal margin not as wide as body of valve. Posterior and anterior slopes short and straight, diverging rapidly towards the lateral margins of valve. Ventral margin extensive and rounded. Posterior auricle slightly smaller than the anterior auricle, both, especially the anterior, separated from the body of the valve by distinct sinuses, which in the impression appear as ridges. The anterior byssal sinus is of comparatively large size. Anterior auricle large and triangular, the outer margin rounded, while the posterior auricle is strongly convex, with an obliquely truncate outer margin.

The surface is marked by primary radiating plications or costæ, fifty in number, closely arranged and sharp. Occasionally there may be interpolated secondary costæ, which originate at the umbonal region and, like the primary, spread out radially towards the margin. The secondary costæ are, however, rare, and when present remain inferior in size to the primary costæ. Concentric growth lines are indistinct in early stages of shell but become more distinct towards the ventral margin of the shell.

The entire sculpture of the valve is crossed by a fine concentric lamination or frill imbrication, which increases in density towards the ventral margin. It is confined more to the intercostal spaces, the tops of the radiating costæ being more or less free from lamination.

The ornamentation on the ears is somewhat similar to the valve ornamentation; the anterior ear possesses six to eight radiating costæ, which occasionally bifurcate. Lamination is also present, and the growth lines become particularly heavy at the extremity. Posterior valve ornamentation consists also of radiating primary costæ, but these are more or less obscured by the numerous well developed concentric growth lines.

The left or convex valve is unknown.

The dimensions of a right valve figured by Etheridge and Dun on plate viii fig. 4 are approximately as follows:—

Height, 86 mm.; width, 88 mm.; dorsal margin, 80 mm.

Localities and Horizon.—New South Wales: Farley (J. Waterhouse); Ravensfield (J. Waterhouse); Pokolbin (C. A. Süssmilch). Tasmania: Huon Road. *Permo-Carboniferous,* Lower Marine Series.

Collection.—Mining and Geological Museum and Australian Museum, Sydney.

AVICULOPECTEN EXTENSUS, *sp. nov.*

(Plate i.)

Description.—The shell is of medium size, equilateral (without ears), and both valves very slightly convex. Valve more or less fan-shaped, being much higher than wide. Dorsal margin as

wide as body of valve. Umbonal region slightly swollen, and the beak is pointed but by no means conspicuous; anterior and posterior margins of valve narrow dorsally but diverge below the ears to form a rather extensive semi-circular ventral margin. The anterior auricle triangular, moderately large, the outer margin rounded, and separated from the valve by a byssal sinus. The posterior auricle is the smaller of the two, with a straight outer edge, and is separated from the rest of the valve by a very slight depression.

The surface of the valves is marked by a series of radiating primary costæ, thirty-five to forty in number, sub-angular, irregularly spaced and varying in size and strength. Occasionally secondary costæ may be interpolated and may be either distinct or result from a bifurcation of a primary costa. Concentric lines marking the growth stages of the shell are distinct and become moderately heavy on the ventral margin. The intercostal spaces or depressions are broad and concave. The anterior ear possesses six radiating costæ which bifurcate, the whole being crossed by a very fine but distinct lamination. The posterior ear is ornamented with fine costæ and these are also crossed by the concentric lamination. Hinge plate straight, and linear.

The dimensions are approximately as follows:—

	Fig. 2.	Fig. 3.	Fig. 1.
Height	73 mm.	75 mm.	73 mm.
Width	60 mm.	58 mm.	65 mm.
Dorsal margin ..	53 mm.	52 mm.	51 mm.

Observations.—The species is represented by a number of right valves and a left valve, all in an excellent state of preservation, and in several instances practically perfect.

It is a very distinct species and is apparently restricted to the Upper Marine Series. *A. squamuliferus* Morris bears a general resemblance to this species, but the chief points of difference may be summed up as follows:

(*a*) *A. extensus* is much higher than wide, whereas *A. squamuliferus* is as wide as, or wider than its height.

(*b*) The posterior ear or auricle in *A. extensus* is far smaller than the anterior ear. In *A. squamuliferus* the ears are equal, or the posterior ear may be the larger of the two.

(*c*) The valve sculpture on both species consists of primary costæ with occasional interpolated secondaries. In *A. extensus* however they are stouter and not nearly as numerous as on *A. squamuliferus*.

(*d*) The frill imbrication or concentric lamination so characteristic of *A. squamuliferus*, although present in *A. extensus*, is so indistinct that it may be discerned only after a close examination.

Locality and horizon.—Coast line between St. George's Basin and Ulladulla, New South Wales. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Type specimen, F.19143; paratypes, F.19194 and F.19144.

AVICULOPECTEN MULTICOSTATUS, *sp. nov.*

(Plate ii.)

Description.—The shell is of moderately large size, more or less subcircular in outline. The right valve is considerably flattened and is inequilateral. Dorsal margin equals about two-thirds the width of the body of the valve. The beak is slightly posterior in position on the hinge line and is pointed and insignificant. Umbonal ridges short, terminating practically at the base of the auricles after which the outline of the shell is semicircular. Anterior ear much greater in size than the posterior ear, which is exceedingly small. Anterior auricle slightly convex, triangular, with a rounded outer margin, and sharply marked off from the remainder of the shell by a distinct byssal sinus. Posterior ear is also triangular, with a straight outer margin.

The sculpture of the valve consists of radiating costæ, concentric growth lines, and a frill imbrication or lamination. The main costæ are about thirty to thirty-five in number, 4-6 mm. wide, flattened and separated by comparatively narrow intercostal spaces. In the umbonal region these costae are devoid of interpolated secondary costæ, but are augmented towards the ventral margin by being traversed along the lateral margins by two fine ribs, dividing each primary costæ into three. Concentric growth lines are numerous, becoming stronger towards the later stages of growth. A fine frill imbrication traverses the whole of the surface ornamentation, giving the shell a characteristic perforated appearance. The sculpture of the anterior ear consists of six to seven primary costæ, crossed by numerous growth lamellæ, which are always more pronounced upon the ears. The posterior ear is practically devoid of costæ, and consists almost solely of fine and sharp growth lamellæ.

The left valve is represented by several specimens, all of which are strongly convex. The surface sculpture of the valve is essentially the same as that of the right valve.

The dimensions of several of the figured specimens, including the holotype, are approximately as follows:

	Fig. 1. (Holotype.)	Fig. 3. (Paratype.)
Height	136 mm.	190 mm.
Width	120 mm.	160 mm.
Dorsal margin	72 mm.	120 mm.

Observations.—This species is represented by a number of exceedingly well preserved specimens from the Upper Marine Series of the South Coast of New South Wales. In the type locality this form was particularly abundant, and a large block in the collection is practically composed of nothing else but valve fragments. As it has not to my knowledge been collected from any other locality, this species no doubt had a very restricted distribution.

In shape and general appearance it resembles *A. squamuliferus*, but may be quite readily distinguished from the latter by its larger size, distinct ornamentation, and the small size of the posterior auricle. It agrees with *A. squamuliferus* in possessing a frill imbrication, which gives the valve an appearance of being perforated.

Localities and horizon.—New South Wales: St. George's Basin: coast line between St. George's Basin and Ulladulla: Kangaroo Point, St. George's Basin. Permo Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Holotype, F.19097; paratypes, F.19513 and F.19377 (Figures 1-3 respectively).

AVICULOPECTEN SPRENTI *Johnston.*

Plate iii and Figure 1.)

Aviculopecten sprentii Johnston, Proc. Roy. Soc. Tas., 1886 (1887), p. 9.

Aviculopecten sprentii Johnston, Syst. Acct. Geol. Tas., 1888, p. 115, pl. xiv, fig. 11.

Aviculopecten sprenti, Etheridge, Jr., and Dun, Mem. of the Geol. Survey of N.S.W., Palæontology, No. 5, Vol. ii, 1906, p. 15 and plates.

Observations.—There are many specimens of this dainty Palæopecten in the Varney Parkes collection. These are usually preserved in the form of left valve impressions and moulds, but in several instances the complete shell, consisting of both valves, has been preserved.

This is the first time that the right or flat valve has been recorded, for no mention of it was made in Johnston's original description, while in Etheridge and Dun's description it is stated that the right valve is unknown. I have therefore taken the opportunity of figuring the right valve and adding further details and measurements to the descriptions already published.

Description.—The shell is of small size, suborbicular, equilateral (without ears) and inequivalve. Dorsal margin or hinge line as long as the width of the shell, which is as high as or higher than wide. The left valve is convex, with short anterior and posterior slopes rapidly converging to the beak, which is sharp and pointed and overhangs the right valve. Umbonal margins slightly concave, diverging laterally at half the height of the shell. Ventral margin broadly rounded, giving the shell a fan or scallop-shaped appearance. Posterior auricle comparatively large, triangular, outer margin obtusely rounded and becoming pointed at the antero-dorsal angle; smaller than anterior auricle, which is also triangular with a rounded outer margin. Anterior ear is more sharply marked off from the remainder of the shell by a distinct byssal sinus.

The sculpture of the left valve consists of primary, secondary, and tertiary costæ. The first are ten to fourteen in number, and are strong and acutely rounded. In the intercostal spaces a secondary rib occupies a median position, and on either side a small tertiary rib is interpolated. The secondary and tertiary costæ are slender and become pronounced only towards the base of the shell. In the umbonal region only primary and secondary costæ are present.

The auricles possess sculpture somewhat similar to that of the valve surface except for the absence of tertiary costæ. The anterior ear is ornamented with four primary and concentric lines of growth. The posterior ear possesses three to four primary costæ with a secondary costa in each intercostal space.

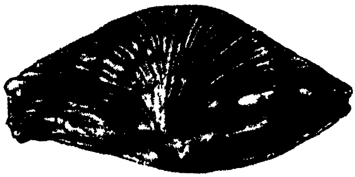

Figure 1.

The right valve is considerably flattened, being slightly convex only in the umbonal region. Ears are absent in all my specimens. The ornamentation of the valve consists of some forty to fifty fine radiating costæ, all regularly arranged and of the same size. The surface of the left valve is, according to Etheridge and Dun, "traversed concentrically in the first instance by latilaminæ, in the second by close frills, which, on passing over the primary and secondary costæ, and on the auricles, rise into acute echinations (almost spines) at regular intervals; there is also a prominent series of denticles along the dorsal margin." This peculiarity is shown to advantage on many of the specimens before me.

Dimensions of several complete and well preserved specimens are approximately as follows:

	Fig. 6.	Fig. 5.	Fig. 4.
Height	40 mm.	32 mm.	29 mm.
Width	38 mm.	32 mm.	27 mm.
Dorsal margin ..	32 mm.	22 mm.	—

Localities and horizon.—New South Wales: Wyro, near Ulladulla; coast line between St. George's Basin and Ulladulla; Tullawalla Point, St. George's Basin; Ulladulla; Gerringong.

Collection.—The Australian Museum, Sydney.

Registered numbers of figured specimens.—Pl. iii, fig. 1, F.19540; pl. iii, fig. 2, F.19536; pl. iii, fig. 3, F.19491; pl. iii, fig. 4, F.19491; pl. iii, fig. 5, F.19412; pl. iii, fig. 6, F.19585.

AVICULOPECTEN GRACILIS, *sp. nov.*

(Plate iv, and Figure 2.)

Aviculopecten media Laseron (pt.). Journ. and Proc. Roy. Soc. of N.S.W., xliv, 1910, pp. 203-4, pl. xv, figs. 2-3.

Description.—The shell is small with a subcircular outline and much higher than wide. The largest specimen attains a height of 37 mm.

The left valve is strongly convex, with a sharp pointed beak median in position and overhanging the hinge line. Anterior and posterior slopes rapidly converge to the umbo. Ventral margin broad and extensive. Anterior auricle larger than the posterior, triangular, with a rounded outer margin, and separated from the body of the valve by a distinct byssal sinus. The posterior auricle is also marked off by a sinus. The anterior lateral portion of the umbonal region is quite flattened, while the postero-lateral margin is rounded.

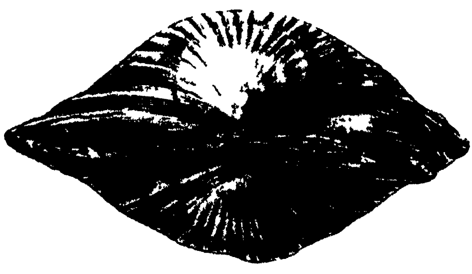

Figure 2.

The surface is marked by radiating primary costæ and concentric lines of growth. The primary costæ originate at the apex of the umbo, where they are sharp and slender, but become more prominent and strong towards the ventral margin. They are twenty-five to thirty in number, and in the later stages of the shell are rounded on top and separated by fairly wide and smooth intercostal spaces. The lines of growth are more pronounced in some specimens than in others, and consist of lamellæ which are very distinct on the tops of the costæ, where they almost form spines or echinations. The ear sculpture is essentially the same as the valve sculpture, the anterior ear possessing eight to ten primary costæ, which occasionally bifurcate, while the posterior ear possesses only five to six. Growth lamellæ are very pronounced on both auricles, particularly on the outer margin. Hinge line straight and almost equal to the greatest width of the shell.

The right valve is not so strongly convex as the left valve and is smaller, the beak not quite extending to the hinge line. Umbonal region has both margins rounded, with a distinct byssal sinus separating the anterior ear from the body of the valve. The ears are similar to those of the left valve. The surface ornamentation is identical with that of the corresponding valve.

The dimensions of several of the figured specimens, including the holotype, are approximately as follows:

	Pl. iv, fig. 1. Holotype.	Pl. iv, fig. 4. Paratype.
Height	38 mm.	25 mm.
Width	34 mm.	21 mm.
Dorsal margin	30 mm.	18 mm.

Observations.—This small and delicate looking Palæopecten is an outstanding type, and one which could not very well be confused with other species of *Aviculopecten*. One could perhaps refer to it as a minute form of *A. squamuliferus* as the surface sculpture is very similar. The strong convexity of both valves and its small size, however, prohibits it being placed with this species.

I have included among the specimens of *A. gracilis*, one of Laseron's type specimens of his *Aviculopecten media*. This author founded his species on two specimens collected from the Wandrawandian Series at Burrier on the South Coast of New South Wales. One was an imperfect right valve with a well preserved auricle, while the second specimen was a nearly perfect cast of the united valves. This latter specimen I have placed with *A. gracilis*, as its characters correspond with those of my species, and not with the characters of *Deltopecten media*, as further specimens which I have at hand prove. It is interesting to note that in this species the

surface of the right valve is marked in a manner similar to the sculpturing of the left, a fact which is unusual in both the Aviculopectens and the Deltopectens.

Localities and horizon.—New South Wales: Conjola: Wyro, near Ulladulla; coast line between St. George's Basin and Ulladulla; Ulladulla; Burrier near Ulladulla (Laseron). Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered numbers of holotype and figured specimens.—F.19166 (holotype); F.19629 (pl. iv, fig. 2); F.19419 (pl. iv, figs. 3 and 5); F.19420 (pl. iv, fig. 4).

AVICULOPECTEN PARKESI, *sp. nov.*

(Plate v, figs. 1-3.)

Description.—The shell is orbicular, inequilateral, and both valves are equally and strongly convex. The hinge line is straight and is equal to the greatest width of the shell. The beak is pointed and prominent and slightly overhangs the hinge line. Anterior and posterior slopes converge to the umbo; the former is longer than the latter, which stops short on the lateral margin of the valve much higher than the anterior, which persists almost down to the ventral margin. This structure, together with the fact that the beak is posterior in position, causes the species to exhibit an obliquity. The antero-lateral portion of the umbonal area consists of a flattened area of considerable width. The ears are uneven, the anterior ear being the larger of the two, and separated from the body of the valve by a very distinct and deep byssal sinus. They are triangular in shape, and the outer margins in both are rounded. The anterior ear possesses a depression, which is almost median in position and separates the auricle into two portions.

The sculpture of this species is almost indistinguishable. It consists of very fine costæ, which radiate out from the umbo, and heavy concentric growth lines. The costæ are very numerous and do not increase in size, being the same at the ventral margin as in the umbonal region. The growth lines are numerous and at even distances from one another become exceptionally heavy. The auricles do not possess any distinctive sculpture, only slight traces of growth lamellæ being present.

The dimensions of the holotype and paratypes are approximately as follows:

	Pl. v, fig. 2. (Holotype.)	Pl. v, fig. 1. (Paratype.)	Pl. v, fig. 3. (Paratype.)
Height	48 mm.	48 mm.	46 mm.
Width	47 mm.	46 mm.	42 mm.
Dorsal margin ..	36 mm.	30 mm.	26 mm.

Observations.—This species is represented by a number of exceptionally well preserved specimens of both the right and the left valves. It is quite distinct from any other Palæopecten known to me, both by virtue of the extreme convexity of both valves and lack of distinct ornamentation. The species which it most closely resembles is *A. englehardti,* which, however, does not possess the strong convexity of the valves and the exaggerated length of the anterior slope. This species is named in honour of Mr. Varney Parkes, whose zealous and untiring collecting in the field made this work possible.

Localities and horizon.—New South Wales: Wyro, near Ulladulla; North Head, Ulladulla; coast line between St. George's Basin and Ulladulla; Gerringong. Permo Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered numbers of holotype and paratypes.—F.19472 (pl. v, fig. 1) (holotype), F.19567 (pl. v, fig. 2), F.19494 (pl. v, fig. 3).

AVICULOPECTEN ENGLEHARDTI, *Eth. and Dun.*

(Plate vi, figures 2 and 3.)

Aviculopecten elongatus De Koninck (*non* McCoy), Rech. Foss. Pal. Nouv-Galles du Sud, 3, 1877, p. 155, pl. 22, f. 5; (*transl.* David and Dun in Geol. Surv. of N.S.W., Mem. Pal., 6, 1898, p. 231, pl. xxii, fig. 5).

Aviculopecten englehardti Eth. Jun. and Dun, Mon. of the Carb. and Permo-Carb. Invert. of N.S.W., Mem. Geol. Survey of N.S.W., Palæontology, No. 5, ii, 1, 1906, p. 17 and figures.

Observations.—I have a number of excellently preserved specimens of this species from the Upper Marine Series collected from various localities. According to the localities given by Etheridge and Dun this species is characteristic both of the Upper Marine and Lower Marine Series. I have figured several of the better specimens for reference and give a list of the localities from which they were collected.

The dimensions of several fairly complete specimens are approximately as follows:

	Fig. 2.	Fig. 4.
Height	39 mm.	53 mm.
Width	35 mm.	52 mm.
Dorsal margin	22 mm.	35 mm.

Localities and horizon.—New South Wales: Tullawalla Point, St. George's Basin; Kangaroo Point, St. George's Basin; Wyro, near Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

AVICULOPECTEN MITCHELLI *Eth. and Dun.*

Aviculopecten mitchelli Etheridge, Jr., and Dun, Mem. Geol. Survey of N.S.W., Palæontology, No. 5, ii, 1, 1906, p. 11 and figures.

Observations.—This comparatively rare species of *Aviculopecten* is not represented in the Varney Parkes collection, for up to the present it has been found only in the Lower Marine Series. One of Etheridge and Dun's type specimens figured in their Monograph on plate i, figure 3, is before me, and I have taken this opportunity of publishing the dimensions, which has not yet been done.

Height	.. .. ..	107 mm.
Width	.. .. ..	85 mm.

Anterior auricle to beak 35 mm. (posterior auricle missing). Convexity of right valve 35 mm.

Locality and horizon.—New South Wales: Allandale, Maitland district. Permo-Carboniferous, Lower Marine Series.

Collection.—The Mining and Geological Museum, Sydney.

DELTOPECTEN MEDIA (*Laseron*).

(Plate vii.)

Aviculopecten media Laseron (pt.) Journ. Roy. Soc. of N.S.W., xliv, 1910, pp. 203-4, pl. xv. fig. 1.

Observations.—There is a large number of beautifully preserved specimens of this species in the collection, including both right and left valves.

This species was originally described and figured by Laseron from two specimens collected from the Wandrawandian Series of Burrier, New South Wales. They were an imperfect right valve with a well preserved auricle, and a nearly perfect cast of the united valves. The latter as already mentioned in this paper has been placed in *Aviculopecten gracilis*. The former specimen, an imperfect right valve, I have been able to determine as belonging to the genus *Deltopecten*, for in many of the specimens before me a small but distinct chondrophore is present.

From the series of specimens I possess many additional particulars have been gained to add to the original description, as well as further measurements, figures, and localities.

Description.—The shell is of medium size, slightly wider than high and with both valves convex, but not strongly so.

The left valve convex and flattened towards the ventral margin. Without the ears the valve would be equilateral. Hinge line straight, linear, grooved with resilium furrows and possessing a chondrophore of comparatively small size. Dorsal margin not as wide as the greatest width of the shell. Umbonal region flattened, with anterior and posterior slopes converging to form the beak, which is pointed, distinct, and slightly overhangs the hinge margin. The ventral margin of the shell is rounded and extensive, giving a fan-shaped appearance. The auricles are characteristically uneven in size and shape. The anterior auricle is extraordinarily large for the size of the valve, and is rectangular to triangular in shape, with a rounded outer margin. The posterior auricle is very small, triangular in shape and also possesses a rounded outer margin. The anterior auricle is separated from the body of the valve by an exceptionally deep byssal sinus, the posterior by only a slight depression.

The sculpture of the valve consists of radiating primary costæ. These are fine and slender in the umbonal region but in the later stages of the shell, towards the ventral margin, become heavy, broad, and rounded on top. They are twenty-four to twenty-six in number, are never bifurcated or interpolated with subsidiary costæ, and are separated from one another by broad and smooth valleys or inter costal spaces. The ornamentation on the ears is indistinct. The anterior ear possesses some six to eight primary costæ, while the posterior ear shows no ornamentation. Growth lines or lamellæ are characteristically absent both on the valves and on the ears.

The right valve is not quite so convex as the left, but in all other respects is very similar.

The dimensions of several of the figured specimens are approximately as follows:

	Fig. 1.	Fig. 4.	Fig. 5.
Height	78 mm.	94 mm.	82 mm.
Width	80 mm.	94 mm.	62 mm.
Dorsal margin	65 mm.	59 mm.	61 mm.
Anterior auricle (from chondrophore)	46 mm.	45 mm.	39 mm.
Posterior auricle (from chondrophore)	19 mm.	14 mm.	22 mm.

Relations and differences.—Laseron pointed out in his paper that this species undoubtedly approached very closely to *Aviculopecten profundus* De Kon. but summarized the differences as follows:

(1) The number of costæ in *A. media* is only about 25, instead of 40 as in *A. profundus*.

(2) In *A. profundus* the radii are crossed by numerous growth lines, producing a cancellated surface. The surfaces of the radii in *A. media* are quite smooth.

(3) The hinge line of *A. media* is slightly shorter than the greatest width of the shell, that of *A. profundus* is broader.

There is certainly a distinct likeness between these two species, but the above differences together with the fact that this species possesses a chondrophore, places it without doubt in the genus *Deltopecten*, thus making the separation complete. The extreme convexity of *A. profundus* also causes it to differ from Laseron's species.

It is noteworthy that the general outline of this species, together with the type of sculpture on the valves, shows only a very slight modification from several valve fragments of *Deltopecten illawarrensis* Morris, sp. (?) which are in the Australian Museum Collection.

This latter species has, however, up to the present been regarded as characteristic of the Lower Marine Series and has been collected at Allandale, in the Maitland district, New South Wales, and at the Mount Britton Gold Field, Queensland, in the Middle or Marine Series of the Bowen River Coal Field.

The main points of difference between these two species may be summarized as follows:

(1) In *D. media* the umbonal region is flattened and the valve itself is more flattened than in *D. illawarrensis*.

(2) The valve of *D. media* is as wide as or wider than high, instead of higher than wide as is usually the case in *D. illawarrensis*.

Further specimens from other localities may prove these species to be identical, as the above differences could possibly be caused by pressure and slight distortion.

Localities and horizon.—New South Wales: Coast line between St. George's Basin and Ulladulla; Wyro, near Ulladulla; Warden Head, Ulladulla; Wandrawandian; Mount Vincent (old collection); Burrier (Laseron).

Collection.—The Australian Museum, Sydney.

Registered numbers of figured specimens.—Pl. vii, fig. 1 (F.19090); pl. vii, fig. 2 (F.19618); pl. vii, fig. 3 (F.20169, Laseron's type); pl. vii, fig. 4 (F.19147); pl. vii, fig. 5 (F.19504).

DELTOPECTEN FITTONI (*Morris*).

(Plate viii.)

Pecten fittoni Morris, Strzelecki's Phy. Desc. N.S.W. etc., 1845, p. 277, pl. 14, f. 2.

Deltopecten fittoni, Etheridge, Jr., and Dun, Mem. Geol. Survey of N.S.W., Palæontology, No. 5, ii, 1, 1906, p. 30 and figures.

Observations.—This species is represented by some twenty exceptionally well preserved specimens from various localities in the Illawarra district; unfortunately they are all right valves. They in no way differ from previous descriptions, the costæ ranging from fifteen to twenty-five in number, all widely separated from one another by broad intercostal spaces. These valleys or intercostal spaces, together with the costæ are traversed by numerous fine radii or costæ, giving the valve a very characteristic appearance and at once separating it from all other Australian Palæopectens. Two specimens are figured, one an internal cast which shows a slight obliquity, and an impression which shows the sculpture to advantage.

The dimensions of the figured specimens are approximately as follows. The dimensions of the largest specimen in the collection are also given.

	Fig. 1.	Fig. 2.	Largest Specimen.
Height	78 mm.	83 mm.	150 mm.
Width	76 mm.	85 mm.	95 mm.
Dorsal margin ..	50 mm.	60 mm.	120 mm.

Localities and horizon.—New South Wales: Conjola; Warden Head, Ulladulla; coast line between St. George's Basin and Ulla dulla; Ulladulla. Permo Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered numbers of figured specimens.—Pl. viii, fig. 1 (F.19438); pl. viii, fig. 2 (F.19146).

DELTOPECTEN DEPRESSUS, *sp. nov.*

(Plate ix, and plate x, figures 1 and 2.)

Description.—The shell is of large size, concavo-convex, and, with the auricles excluded, is equilateral. Shell thin, the general outline subcircular, and as wide as high, or in some cases slightly higher than wide. The largest specimen is 195 mm. high.

The left valve is gently convex, becoming slightly flattened towards the ventral margin. The dorsal margin is not nearly as wide as the greatest width of the valve. The anterior and posterior

slopes are short, very much depressed, and converge to form a blunt and flattened umbo. The beak slightly overhangs the hinge margin and is median in position. The anterior and posterior auricles are similar in size and shape. They are both triangular, with straight outer margins. The former is separated from the body of the valve by a slight depression, but the junction of the latter with the valve is indistinguishable. The hinge area is exceedingly broad, particularly beneath the umbones, where it is excavated into a large and rounded rectangular chondrophore pit, which narrows towards the anterior and posterior extremities.

The ornamentation of the valve consists of primary, secondary, and tertiary costæ with concentric growth lines. The primary costæ are about twenty in number, originating in the umbonal region and spreading out in fan-like manner to the ventral margin. In the younger specimens these costæ are more or less slender with sharp tops, but in the larger specimens they have become heavier and more swollen and rounded on top. They are separated from one another by broad and smooth valleys or intercostal spaces. Along the centre of each intercostal space a secondary costa is found, and between these and each primary at least one and sometimes two tertiary costæ occur. These are very fine and in some specimens are indistinguishable. Concentric growth lines are present but are not conspicuous. Ornamentation on the ears is absent, except for growth lines.

The right valve is concave, more or less flattened in the umbonal region and strongly concave at the ventral margin. The ears are similar to those of the left valve, but the sculpture differs in that only primary costæ are found. These are exceptionally heavy, about twenty in number, and separated by broad valleys or intercostal spaces.

The dimensions of several of the figured specimens as well as the holotype are approximately as follows:

	Pl. ix, fig. 1.	Pl. x, fig. 1.
Height	195 mm.	180 mm.
Width	167 mm.	173 mm.
Dorsal margin	111 mm.	115 mm.

Chondrophore pit (pl. ix, fig. 2).—Width 30 mm., height 15 mm.

Observations.—This species is represented by several fairly well preserved specimens, some of which are complete shells, consisting of both right and left valves. Among the Deltopectens there is nothing to my knowledge which in any way compares with this almost gigantic form of Palæopecten. The specimens can almost be divided into two series by their sculpture; in one series, which I consider are immature shells, the sculpture is composed of fine costæ, whereas in the adult forms the costæ become thickened and

strong. The series of specimens which I have examined shows almost a graded variation from the adult to the immature, so that separation under these circumstances is impossible. In the Taiyuan Series of North China a new species of *Deltopecten* has been described quite recently by Yatseng T. Chao, Geologist to the Geological Survey of China.[7] This species, *Deltopecten giganteus*, has many points in common with my species, but a glance at the figures proves that they could not be placed together. The main points of difference are in the costæ and they may be summarized as follows:

(1) In *D. giganteus* the primary and secondary costæ are numerous, and closely packed together. In *D. depressus* the primary costæ are much larger and more rounded and are separated by intercostal spaces of considerable width. The secondary costæ are also much more slender than in *D. giganteus*.

(2) In *D. giganteus* the anterior ear is distinct and is separated from the body of the valve by a distinct and deep byssal sinus, whereas in *D. depressus* the ears are not distinctly marked off, the valve practically merging into the ears.

Locality and horizon.—Kioloa, near Ulladulla, New South Wales. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered numbers of holotype and figured specimens.—Plate ix, fig. 1 (F.19098); plate ix, fig. 2 (F.19532); plate x, fig. 1 (F.19193); plate x, fig. 2 (F.19485).

DELTOPECTEN *cf.* GIGANTEUS *Chao.*

(Plate xi.)

Deltopecten giganteus Chao, Geol. Survey, China, (B), ix, 3, pp. 36-37, pl. iii, figs. 1-3; pl. iv, figs. 1-3.

Observations.—In the Varney Parkes collection there is a portion of a specimen which corresponds perfectly with the description of this species and also agrees with the figures. It consists of the dorsal portion of a complete specimen, and shows therefore the dorsal halves of both valves as well as the hinge area and the chondrophore. The description of the specimen which I have examined is as follows:

The shell if it were complete would be of large size and as wide as high. The shell itself is thin and fragile.

[7] Chao.—*Loc. cit.*, p. 36-37, pl iii, figs. 1-3, pl. iv, figs. 1-3

The left valve is strongly convex, particularly in the umbonal region. The dorsal margin is not nearly as wide as the greatest width of the valve. The anterior and posterior slopes are depressed and converge to form the umbo, which is itself depressed and pointed. It slightly overhangs the hinge margin. The hinge area is broad, and under the umbones is excavated into a chondrophore pit which is fairly large. The hinge area is linear, marked by numerous fine horizontal striations. The ears on the left valve are absent.

The sculpture consists of primary and secondary costæ. The former are about twenty-five to thirty in number and are heavy and wide. They vary in size, some being almost twice as thick and prominent as others. In the umbonal region they are uniform in thickness and the secondary costæ are absent. These are much smaller than the primary, and appear to originate a considerable distance from the umbo. They occur interpolated between the primary costæ. Intercostal spaces are small and acute, giving the costæ an appearance of being closely packed together. Concentric growth lines are present and numerous, and, as pointed out by Chao, "are regular and continuous in the early stages of the shell, becoming later on more distant and at the same time confined mainly to the tops of the radiating plications where they rise as scale-like projections."

The right valve is more or less flattened except in the umbonal region, where the shell is considerably swollen. The beak is insignificant and terminates in a median position on the margin. The anterior ear is triangular in shape with a rounded outer margin. It is separated from the body of the valve by a distinct byssal sinus. The posterior ear unfortunately is missing.

The sculpture on this valve, however, is slightly different from that of the left valve. It consists of primary and secondary costæ, but the former are more numerous, some thirty to thirty-five being present. The secondary on the other hand only occasionally occur interpolated between the primary costæ. Intercostal spaces are wider and more concave than on the left valve. The ornamentation on the ears is similar to that of the valve.

Locality and horizon.—Kioloa, near Ulladulla, New South Wales. Permo-Carboniferous, Upper Marine Series.

The dimensions of this specimen are given; from these the large size of the shell may be imagined.

	Pl. xi, fig. 2.
Height of fragment	103 mm.
Width of fragment	160 mm.
Dorsal margin	80 mm. ?

Collection.—The Australian Museum, Sydney.

Registered number of figured specimen is F.19451.

DELTOPECTEN LENIUSCULUS *Dana.*

(Plate xii, and figures 3-4.)

Pecten leniusculus Dana, Am. Journ. Sci., 1847, (2), iv, p. 160.
Pecten leniusculus Dana, Wilkes U.S. Explor. Exped., 1849, x (Geol.), p. 704, atlas, pl. ix, fig. 6 *a* and *b*.
Deltopecten leniusculus (Dana), Etheridge, Jr., and Dun, Mon. of the Carb. and Permo-Carb. Invert. of N.S.W., Mem. Geol. Survey of N.S.W., Palæontology, No. 5, ii, 1, 1906, p. 28 and figures.

Deltopecten rienitsi Mitchell, Proc. Roy. Soc. N.S.W., lii, 2, 1927, p. 104, pl. ii, figs. 1 and 2.

Observations.—Dana's original description of this species was comparatively brief, but further details have been added by Etheridge and Dun. This species is represented by at least some sixty or seventy specimens, including very well preserved specimens of both valves. In the synonomy of this species I have placed Mitchell's *Deltopecten rienitsi.* This specimen from which the species was founded is, I consider, a distorted form of *D. leniusculus.* It appears to have been very abundant in our Upper Marine Series. Several of the better preserved specimens have been figured, and the dimensions and localities are also given.

Figure 3

Figure 4.

The dimensions of several of the figured specimens are approximately as follows:

	Pl. xii, fig. 1.	Pl. xii, fig. 2.	Pl. xii, fig. 3.
Height	85 mm.	68 mm.	122 mm.
Width	87 mm.	68 mm.	122 mm.
Dorsal margin ..	63 mm.	59 mm.	80 mm.

Localities and horizon.—New South Wales: Warden Head, Ulladulla; coast line between St. George's Basin and Ulladulla; North Head, Ulladulla; Bundanoon Gully; Wyro, near Ulladulla; Wollongong and Conjola. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered numbers of figured specimens.—Pl. xii, fig. 1 (F.19407); pl. xii, fig. 2 (F.19415); pl. xii, fig. 3 (F.19634); pl. xii, fig. 4 (F.19548); pl. xii, fig. 5 (ptn. of F.19605).

Deltopecten comptus (*Dana*).

(Plate xiii, figures 1-4.)

Pecten comptus Dana (*non* McCoy), Am. Journ. Sci. (2), iv, 1847, p. 160.

Deltopecten subquinquelineatus Etheridge, Jr., and Dun, Mem. Geol. Survey of N.S.W. Palæontology, no. 5, ii, 1, 1906, p. 26.

Observations.—Dana's species, *Pecten comptus,* was placed by Etheridge and Dun in the synonymy of *D. subquinquelineatus,* as it was thought by these authors to be identical with that species. There has, however, since come to hand in the collection I am now dealing with several excellently preserved specimens which differ from the typical *D. subquinquelineatus* but which I am able to associate with Dana's type. This is a definite coarsely ribbed form, and so unlike *D. subquinquelineatus* that I have no hesitation in re-establishing Dana's species. As the volume in which his original description appears is by no means common, I reproduce it here.

"*Pecten comptus* (Dana).—Orbicular, 20-22 larger costæ, obtusely triangular, with the sulci broadly concave, and occupied with a medial costa, and 1 to 3 smaller; costæ naked, without markings or transverse striae. Ears large, longitudinally marked with fine diverging costæ. Length and height, 2¼ inches; distance, at the lower margin, between the middle of two larger costæ, to nearly ¼ inch. Plate 9, fig. 5, natural size.

"Harper's Hill.

"The specimen is a single convex valve. The shell is white and well preserved, and is less than a third of a line thick."

The specimen mentioned by Dana as being figured on plate 9, fig. 5, is his type specimen. The cast of this has been refigured in this paper on plate xiii, fig. 3.

Additional details gained from the series of specimens in the collection are as follows.

This species is represented by specimens of what I take to be both valves, some being convex while others are considerably flattened. The ears are absent on the flattened or right valves.

Left valve is strongly convex, as wide as high and with a subcircular outline. The dorsal margin is not as wide as the valve below. Anterior and posterior slopes rapidly converge to form the beak, which is pointed and prominent and overhangs the hinge line. Umbonal margins are curved and reach the lateral margins about midway down the shell. Ventral margin rounded, giving the shell a somewhat fan-shaped appearance The auricles are uneven, the anterior ear being smaller than the posterior ear. The former is rectangular in shape with a rounded outer margin. The posterior ear is broadly triangular and also possesses a rounded outer margin. A byssal sinus separates the anterior ear from the body of the valve, while the posterior ear is marked off only by a shallow depression.

The sculpture is essentially the same on all the specimens, and consists of primary, secondary and tertiary costæ. Concentric growth lines are present. The primary costæ are twenty to twenty-five in number, originating at the apex of the umbo and radiating out to the ventral margin. These are slender in the umbonal region but in the later stages of the shell, towards the ventral margin, become considerably thickened and coarse. The secondary costæ occur interpolated between the primaries, arising near the base of the umbo and extending to the ventral margin. Between each primary and secondary costa a single or occasionally two tertiary costæ occur. The auricles are ornamented in much the same manner as the valves. The anterior ear is ornamented with six primary costæ with intercalated secondaries, but on the posterior ear primary costæ are lacking, the ear being covered with fine costæ. Heavy growth lines occur at regular intervals, both on the body of the valve and on the auricles, denoting no doubt growth stages of the shell.

The right valve is flattened considerably, but in other respects is similar to the left valve.

The dimensions of several of the figured specimens are approximately as follows:

	Fig. 2.	Cast of Dana's Type. Fig. 3.
Height	66 mm.	56 mm.
Width	62 mm.	62 mm.
Dorsal margin	56 mm.	38 mm.

Relations and differences.—By virtue of its large and coarse primary costæ this species resembles *D. fittoni,* but differs in the number and character of the secondary and tertiary costæ as well as in its small size. Its ornamentation also definitely separates it from *D. subquinquelineatus.*

Localities and horizon.—New South Wales: Illawarra (cast of Dana't type); Tianjarra, Wandrawandian Creek, South Coast; North Head, Ulladulla; Upper Burragorang Valley near the Oaks, 7 miles from Nattai River (W. H. Glover); Lake Tullawalla, St. George's Basin. Permo-Carboniferous, Upper Marine Series.

Western Australia: Low Hill, loc. m. 308, 17 miles east of Minginew (Carb.? A. Gibb Maitland).

Registered numbers of figured specimens.—Pl. xiii, fig. 1 (F.19427), pl. xiii, fig. 2 (F.19523), pl. xiii, fig. 3 (cast of Dana's type L.683), fig. 4, micro-photograph (F.19427).

Collection.—The Australian Museum, Sydney.

DELTOPECTEN FARLEYENSIS *Eth., Jr., and Dun.*

(Plate vi, figs. 1-3.)

Deltopecten farleyensis Etheridge, Jr., and Dun, Mem. Geol. Survey of N.S.W., Palæontology, No. 5, ii, 1, 1906, p. 29 and figures.

Observations.—Etheridge and Dun remarked in their observations that there was a general similarity between *D. farleyensis* and *D. leniusculus*, in that the ornamentation was practically identical, but the former differed by its fan-shaped outline and great length of its dorsal margin. On looking over several of their figures of *D. farleyensis*, the similarity in form to *D. leniusculus*, led me to re-examine critically the specimens, which resulted in the following conclusions. The specimens figured on plate xvi, figure 4, plate vi, figure 2, and plate xiii, figure 5, are undoubtedly the right valves of *D. leniusculus* and not *D. farleyensis*. The remaining figured specimens together with an internal cast and complete specimen with united valves in the Australian Museum collection are to my knowledge the only known specimens of this species. It is interesting to note that the specimens which have recently come to hand have been collected from the Upper Marine Series of the Illawarra district. Mr. Varney Parkes collected one at Ulladulla, while the other was collected some years ago at Jamberoo. This definitely places on record the fact that *D. farleyensis* occurs both in the Lower and Upper Marine Series of the Permo-Carboniferous. All Etheridge and Dun's specimens were collected from the Lower Marine Series.

These constitute a distinct and satisfactory group, from which the following details have been derived, and which are published as an addition to the original description.

Description.—In general outline the valves are subcircular, as high as wide, and both valves are more or less flattened. The shell itself is thin and fragile and as a result the majority of specimens are internal casts showing no ornamentation.

The left valve is gently convex, swollen in the umbonal region, and flattening out towards the ventral margin, which is rounded. The anterior and posterior slopes are depressed and converge widely to form a comparatively broad umbo, which slightly overhangs the hinge margin. Umbo is median in position. The hinge area is broad and is coarsely striated or grooved. Beneath the umbones an excavation or chondrophore pit is formed. The dorsal margin is exceptionally long and straight, and is a third as long again as the valve below, both in width and height. The ears differ in size and shape. The anterior ear is triangular in shape with the outer edge rounded, and is separated from the body of the valve by a comparatively deep and broad byssal sinus. The posterior ear is alate, with a straight outer edge. The posterior dorsal angle is pointed.

The ornamentation consists of numerous closely packed primary costæ with occasional intercalated secondary costæ. The former are slender and sharp, and apparently retain the same width on the ventral margin as on the umbonal region. The same type of sculpture is carried on to the auricles, where concentric growth lines also occur.

The right valve is flattened, slightly swollen in the umbonal region, becoming slightly concave at the ventral margin. The sculpture consists of a large number of radiating primary costæ, which are, however, separated from one another by broad and smooth intercostal spaces. The costæ are fine and delicate. The beak is insignificant and does not extend beyond the hinge margin.

The dimensions of a small specimen figured in Etheridge and Dun's monograph in plate xxiii, figure 6, and a large specimen figured in plate vi, figure 1 in this paper, are approximately as follows:

	Small Specimen.	Large Specimen.
Height	24 mm.	79 mm.
Width	24 mm.	80 mm.
Dorsal margin	38 mm.	103 mm.

Relations and differences.—As mentioned earlier this species has a slight resemblance to *D. leniusculus,* but a glance at the dimensions of both species proves that they must undoubtedly be disassociated from one another. The extraordinary length of the dorsal margin of this species makes it an outstanding type, as no other species of *Deltopecten,* to my knowledge, could be compared with it.

Localities and horizons.—New South Wales: Jamberoo (J. R. Lievers); Ulladulla. Permo-Carboniferous, Upper and Lower Marine Series.

Collection.—The Australian Museum, Sydney.

Registered number of figured specimen, F.16895.

DELTOPECTEN LIMÆFORMIS (*Morris*).

(Figure 5.)

Pecten limæformis Morris, Strzelecki's Phys. Descrip. of N. S. Wales, etc., 1845, p. 277, plate xiii, fig. 1.

Deltopecten limæformis (Morris), Etheridge, Jr., and Dun, Mem. Geol. Survey of N.S.W., Palæontology, No. 5, ii, 1, p. 22 and figures.

Observations.—This species is represented by only one imperfect specimen collected from the Lower Marine Series at Harper's Hill in the Maitland district. This specimen shows the ornamentation to advantage, but otherwise is lacking in distinct characters. The dimensions of two specimens, one figured in Etheridge and Dun's monograph on plate xi, figures 1 and 2, and a specimen in the

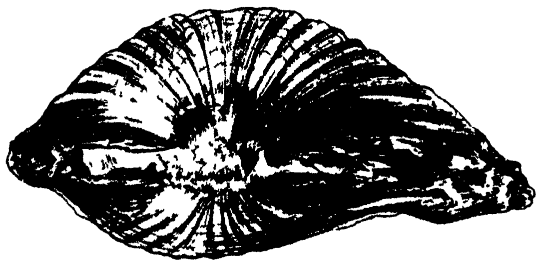

Figure 5

Museum collection, are approximately as follows:

	Figured Specimen.	Museum Specimen F.10866.
Height	160 mm.	135 mm.
Width	141 mm.	140 mm.
Dorsal margin	—	80 mm. ?
Convexity of both valves in umbonal region ..	50 mm.	50 mm.

Collection.—The Australian Museum, Sydney.

DELTOPECTEN CLARKEI, *sp. nov.*

(Plate xiv, and figure 6.)

Description.—This species is represented by several internal casts of united valves, and in each specimen the ears are missing. The shell is circular in outline and is as high as wide, or slightly higher than wide.

The left valve is convex, being swollen at the umbonal region and becoming flattened towards the margins. The anterior, posterior, and ventral margins rounded. The anterior and posterior slopes short and depressed, diverging widely from the umbo. Umbo pointed and prominent, overhanging the hinge margin. The evidence left by the ears points to the anterior being the larger of the two. It was separated from the valve by a distinct and acute byssal sinus. The posterior ear merged almost imperceptibly into the valve. A distinct chondrophore is present on the hinge area.

The ornamentation is absent on all my specimens.

Figure 6

The right valve is flattened, being only slightly swollen at the umbo. The umbo itself is insignificant and blunt and does not extend to the hinge margin. In all other respects it is similar to the left valve. The sculpture on this valve is shown and consists of primary costæ. These are about forty in number, angular in shape and fine and slender. They are separated by broad and smooth valleys or intercostal spaces.

The dimensions of the holotype and paratype are approximately as follows:

	Holotype. Pl. xiv, fig. 1.	F.10861.	Paratype. Pl. xiv, fig. 2.
Height	116 mm.	122 mm.	96 mm.
Width	109 mm.	111 mm.	103 mm.
Dorsal margin	—	60 mm. ?	50 mm. ?
Convexity of both valves at umbo ..	26 mm.	26 mm.	30 mm.

Observations.—In plate x, figure 3, Etheridge and Dun in their monograph figured a specimen which they called an internal cast of the united valves of *D. limæformis*. Additional specimens that have come to hand prove, however, without any doubt that this specimen must be placed with *D. clarkei*. The dimensions of this specimen are given in the middle column of the above measurements.

This species resembles *D. limæformis* to a certain extent, but the chief points of difference may be summed up as follows:

(1) In *D. clarkei* the right valve is practically flat, whereas in *D. limæformis* both valves are strongly convex.

(2) The umbo of the left valve of *D. clarkei* is long and overhangs the hinge margin. The umbo of the right valve does not extend to the hinge margin. In *D. limæformis* the umbones are practically equal and do not overhang the hinge margin to any extent.

(3) The smaller size and absence of a distinct oblique depression on the posterior end of the valve is also a marked difference.

Localities and horizon.—New South Wales: Gerringong; Sussex Inlet; Bomaderry (F. Mitchell). Permo-Carboniferous, Upper Marine Series.

Registered numbers of holotype and paratype, Fig. 1 (F.19526), paratype (F.19524).

Collection.—The Australian Museum, Sydney.

DELTOPECTEN, sp.

(Plate vi, figure 4.)

Included in the material collected by Mr. Varney Parkes is an internal cast of a Deltopecten which is a distinct type, and quite different from any other species of the above genus. For the purpose of identification I am publishing the figure, which is a cast of the right valve, and a description of the characters which may be ascertained from this cast. It is of interest in that it is one of the very few Deltopectens collected in the Wandrawandian Series at Tianjarra in the Illawarra district, New South Wales.

The right valve is strongly convex, oblique and asymmetrical, and produced somewhat posteriorly. The valve is much higher than wide and the dorsal margin is not as wide as the greatest width of the valve below. The anterior and posterior slopes are accentuated and diverge more or less sharply from the umbo, which is prominent and pointed and extends to the level of the hinge margin. The anterior and posterior slopes reach the margin of

the shell one-third the distance of the valve from the hinge line. This gives an extensive anterior, posterior, and ventral margin, which is semi-circular. The hinge area is broad and strong and beneath the umbones is excavated to form a chondrophore pit of large size allowing for different proportions. The anterior and posterior auricles are similar in size and form, the posterior auricle being perhaps slightly more convex than the former. A sinus is absent.

The ornamentation of the shell has not been preserved. The left valve apparently was also strongly convex with a prominent umbo which slightly overhung the hinge area.

The dimensions of this specimen are approximately as follows:

Height, 73 mm.; width, 61 mm.; dorsal margin, 40 mm.

Locality and horizon.—New South Wales: Tianjarra. Wandrawandian Creek gullies, South Coast. Permo Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered number of figured specimen, F.19428.

DELTOPECTEN SUBQUINQUELINEATUS (*McCoy*).

(Plate XV.)

Pecten subquinquelineatus McCoy, Ann. Mag. Nat. Hist., 1847, xx, p. 398, pl. 17, f. 1.

Deltopecten subquinquelineatus (McCoy), Etheridge, Jr., and Dun, Mem. Geol., Survey of N.S.W. Palæontology, No. 5, ii, 1, 1906, pp. 26-28 and figures.

Observations.—This species is represented by a series of thirty or more exceptionally well preserved specimens from various localities in the Upper Marine Series of the South Coast district of New South Wales. They include both left and right valves and also complete specimens of united valves. All of these agree practically in every detail with the description already published of the typical *D. subquinquelineatus*.

Several of the more complete specimens are figured for reference, a left valve and two right valves which show to advantage the valve sculpture. A photo-micrograph of the ornamentation is also published, as well as further localities and the dimensions of the figured specimens.

The dimensions are approximately as follows:

	Fig. 2.	Fig. 3.	Fig. 4.
Height	68 mm.	48 mm.	43 mm.
Width	70 mm.	50 mm.	48 mm.
Dorsal margin ..	46 mm.	49 mm.	—

..*Localities and horizon.*—New South Wales: Gerringong; Wyro, near Ulladulla; Warden Head, Ulladulla; coast line between St. George's Basin and Ulladulla; Tullawalla Point, St. George's Basin. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered numbers of figured specimens.—Pl. xv, fig. 1 (portion of F.19387); pl. xv, fig. 2 (F.19522); pl. xv, fig. 3 (F.19449); pl. xv, fig. 4 (F.19387).

DELTOPECTEN SUBQUINQUELINEATUS, *var.* DELICATULA, *var. nov.*

(Plate xvi.)

Description.—The shell is of large size and is as wide as high. The general outline is sub-circular and without ears would be equilateral. The largest specimen is 108 mm.

The left valve is gently convex, somewhat fan shaped in appearance, with a large ventral margin. The anterior and posterior slopes are steeply inclined and diverge from the umbo in a slight curve and meet the anterior and posterior margins about midway down the shell. The umbo is sharp and prominent and slightly overhangs the hinge area. The auricles differ in size and shape. The anterior auricle is smaller than the posterior, and has a straight outer margin. The posterior auricle has the outer margin rounded and is broadly triangular in outline. The former is separated from the valve below by a distinct byssal sinus. The hinge area is broad and striated. Chondrophore pit is situated below the umbones.

The sculpture of the valve consists of primary and secondary costæ, which radiate towards the ventral margin. The primary costæ are about thirty in number and originate at the apex of the umbo. In between these the secondary costæ are formed, as many as three or four being present, which gives the valve a closely packed costate appearance. Tertiary costæ are absent.

The right valve is considerably flattened, but in all other respects is practically identical with the left valve.

The dimensions of the holotype and the paratype are approximately as follows:

	Fig. 1. (Holotype.)	Fig. 2. (Paratype.)
Height	80 mm.	104 mm.
Width	78 mm.	114 mm.
Dorsal margin	70 mm.	78 mm.

Observations.—Etheridge and Dun have already pointed out that in *D. subquinquelineatus* great variation is exhibited in the sculpture and slightly in the general outline. The series of specimens from which the variety *D. subquinquelineatus* var. *delicatula* is made, exhibit the variation so constantly that I consider they merit at least varietal rank. The chief points by which they differ from the typical species are the absence of tertiary costæ and the great number of primary and secondary costæ. The general out line of this variety and its large size also makes it a distinct group. The concentric growth lines and lamellæ, so distinctly shown in the photo-micrograph is also a distinct character of the variety, although it is not so pronounced in all specimens.

Localities and horizon.—New South Wales: North Head, Ulla dulla; Ulladulla; coast line between St. George's Basin and Ulla dulla; Wandrawandian Creek; Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered numbers of figured specimens.—Fig. 1 (F.19486, holotype); fig. 2 (paratype F.19092); fig. 3 (portion of F.19204).

DELTOPECTEN LATA, *sp. nov.*

(Plate v, figures 4 and 5.)

Description.—This species is represented by a number of exceptionally well preserved specimens of both right and left valves. The shell is scallop-shaped, equilateral (without ears) and equivalve. It is a small form, rarely exceeds 36 mm. in height, and is much wider than high.

The valves are strongly convex, with the anterior and posterior slopes curved and rapidly diverging from the umbo. The umbo is prominent and pointed and slightly overhangs the hinge margin. The auricles differ from one another in that the anterior ear margin is rounded. The shape is broadly triangular. The posterior ear is comparatively large, with a straight outer margin, and the postero-dorsal angle is pointed. The hinge line is straight, not nearly as wide as the greatest width of the valve. Beneath the umbones on the narrow hinge area a small excavation marks the chondrophore pit.

The sculpture consists of primary and secondary costæ. The former are twenty to twenty-five in number, originating at the apex of the umbo and radiating towards the ventral margin. They are fine and angular and are separated from one another by broad intercostal spaces. Along the centre of each intercostal space or valley a secondary costa is found. These are inferior in size to the primary and originate at the base of the umbonal region. The auricles are ornamented with costæ of one size and range from six to eight in number. The ornamentation is traversed by a close frill imbrication or growth lamellæ, which when passing over the primary rise into acute echinations, almost spines.

The dimensions of several specimens, including the holotype and the paratype, are approximately as follows:

	Holotype. Fig. 4.	Paratype. Fig. 5.	Paratype. F.19515.
Height	29 mm.	34 mm.	38 mm.
Width	35 mm.	47 mm.	47 mm.
Dorsal margin ..	24 mm.	28 mm.	31 mm.

Observations.—This is a particularly handsome little shell quite different from any other species of *Deltopecten.* It is similar in its ornamentation, and at first sight in shape, to *Aviculopecten sprenti,* the only other species of Palæopecten which it in any way resembles. The chief points of difference may be summed up as follows:

(1) *D. lata* possesses a chondrophore, which in *A. sprenti* is absent.

(2) In *D. lata* the shell is much wider than high, in *A. sprenti* as wide as high.

(3) In *A. sprenti* the dorsal margin is as wide as the greatest width of the body, in *D. lata* the dorsal margin is not nearly as wide as the valve.

Localities and horizon.—New South Wales: Maitland district; North Head, Ulladulla; coast line between St. George's Basin and Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Registered numbers of holotype and paratype.—Pl. v, fig. 4 (holotype, F.19624); fig. 5 (paratype, F.19514); (paratype F.19515).

ACKNOWLEDGMENTS.

I have pleasure in acknowledging my indebtedness to Mr. W. S. Dun, Palæontologist to the Geological Survey and Lecturer

in Palæontology, University of Sydney, whose cordial assistance, advice and criticism have been of great value in the preparation of this paper. To Mr. G. C. Clutton my best thanks are due for the excellent photographs and photo-micrographs, and to Miss Joyce K. Allan I am deeply indebted for the drawings of the text-figures.

PALÆONTOLOGICAL NOTES No. 1.

MACROPUS TITAN OWEN AND *THYLACOLEO CARNIFEX* OWEN.

By

C. Anderson, M.A., D.Sc.

(Plates xvii-xxiii.)

Macropus titan *Owen.*

(Plates xvii-xviii.)

Macropus titan Owen, *in* Mitchell's Three Expeditions into the Interior of Eastern Australia, 2nd Edit., ii, 1838, p. 360.

Macropus titan Lydekker, Brit. Mus. Cat. Foss. Mamms., Part v, 1887, p. 225.

Macropus magister De Vis, Proc. Linn. Soc. N. S. Wales, x, 1894, p. 120.

On a recent visit to the Wellington Caves, New South Wales, a well known depository of fossil marsupials, Mr. G. C. Clutton of the Museum Staff and myself obtained the greater part of a macropod skull, which was firmly embedded in the red cave earth at a depth of about seventy feet. On examination this was found to conform closely to Owen's description of *Macropus titan*, a species first recorded from the same locality. Our specimen, though it belongs to a young individual and has several marks of immaturity, is highly interesting in that certain features are preserved which have not been previously described. The opportunity has also been taken to examine other cranial remains of this form and to review De Vis' species *Macropus magister*, which I find to be a synonym of *M. titan*.

Skull (Pl. xvii, figs. 1-3).—The skull (F.18665) lacks the occipital bones and most of the basicranial region, the anterior part of the nasals and the incisor teeth. In profile it ascends gently from the interparietal to the coronary suture, in front of which it is almost straight dorsally. The walls of the nasal chamber are slightly swollen, the sides of the muzzle almost parallel; the nasals expand only slightly posteriorly. The opening of the lachrymal canal lies wholly in the lachrymal bone but close to the maxillo-lachrymal suture. Supraorbital edges not sharp, but continued backwards in temporal ridges, which bound a median depressed

area; no sign of a postorbital process; intertemporal constriction slight (a mark of youth).

Anterior palate with moderately sharp edges, its least breadth (20·6 mm.) going less than two and a half times into the diastema. Posterior palate, so far as preserved, complete except for a small slit near the palato-maxillary suture. Anterior palatine (incisive) foramina slightly longer than m^1, commencing in front of the middle of i^3 and extending back to the maxillo-premaxillary suture. In the premaxilla, external to and slightly behind the incisive foramen, and in contact with the maxillo-premaxillary suture, is the outlet of the alveolar branch of the infraorbital nerve, from which it comes off in the infraorbital canal. Wood Jones has stressed the diagnostic importance of the position in relation to the incisive foramen of this opening,[1] which he terms the anterior palatine or naso-palatine foramen. This, however, is an unsuitable name, for the naso-palatine nerve does not, as he supposes, emerge through this outlet but from the incisive foramen. I would suggest the name *inter-alveolar foramen* for this opening, which is a conspicuous feature in all macropodine skulls; its position in *Macropus titan* approaches that seen in *M. giganteus*.

Dentition.—As shown by the alveoli i^1 is larger than i^2, and i^3 is long antero-posteriorly, its alveolus measuring approximately 13 mm. The cheek teeth present are p^3, mp^4, m^1, m^2 (in *alveolo*).

The third premolar (Pl. xviii, figs. 4, 5), which is slightly worn on the internal cusps, is shorter than m^1, hour-glass shaped, the constriction in front of the middle, the posterior segment wider than the anterior. Buccal edge trenchant, with two cusps, the posterior the larger. The lingual margin is shelf-like, with anterior and posterior cusps and a low tubercle in the valley between. The fourth premolar (secator) was extracted from its crypt and examined (Pl. xviii, figs. 6, 7); the roots are not completely formed but the characters of the crown are distinctive. Its antero-posterior length somewhat exceeds that of p^3, but it has less width. There are two external cusps, the anterior pyramidal, though slightly compressed laterally, the posterior sharp-edged and connected with the single postero-internal cusp by a ridge, behind which is a basin.

The first true molar (Pl. xviii, figs. 1-3) is practically unworn and displays very distinctly the characters of the upper molars of *Macropus titan*. The anterior shelf is short, bounded in front by a well marked ridge, which is connected to the anterior loph by a conspicuous bridge (fore link of Owen); the prebasal ridge at its highest point and the fore link are as high as the mid link. The latter is well developed, and shows a slight notch behind the middle.

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[1] Wood Jones.—Proc. Zool. Soc., 1924, i, p. 457; Mammals of South Australia. Part ii, pp. 249, 254 (Adelaide, Govt. Printer, 1924).

The posterior loph has a greater transverse curvature than the anterior, and the "pocket" on the posterior aspect of the tooth described by Owen,[2] and formed by the continuation backward, upward, and outward of the inner end of the posterior loph as a "postbasal" ridge which ends at the postero-external margin of the base of the crown, is well marked, as is also the vertical groove near the lingual margin of this posterior fold.

The collection contains an imperfect skull of a mature *Macropus titan,* obtained from the Wellington Caves and figured but not described by Ramsay[3]; this affords a useful comparison with the immature skull described above. The anterior part of the facial region is wanting, and the zygomatic arch of the right side is incomplete, but the cheek teeth are well preserved, particularly on the right side, which shows p^4 and four molars, the fourth very slightly abraded, so that it may be assumed that the animal was not quite full grown. The intertemporal constriction is relatively much more marked, and there is a slight sagittal crest where in the young specimen there is a depressed area on the parietal vertex. The anterior opening of the infraorbital canal is well forward (about 24 mm. in front of the level of the lachrymal foramen), and six mm. behind the lower edge of the antorbital foramen is the opening leading down into the maxilla are described by Owen.[4] This opening is not present in the skull of the younger specimen, and it is not shown by all maxillary fragments in the collection, so that, apparently, it is not a constant feature. The teeth of this more mature individual conform so closely to those of the recently discovered skull that there can be no doubt concerning the specific identity of the two specimens.

From the collection contained in the Museum two maxillæ, each with a complete cheek series but of different ages, were selected for comparison; both are from the Wellington Caves. One (F.20887) is not quite adult, as p^3 has not been shed and m^4 has not erupted, the other (F.20886) is "aged," and apparently slightly older than F.7273. Measurements of the teeth were made and are embodied in the subjoined table of dimensions; the breadth of premolars was taken across the (wider) posterior portion, of molars across the anterior loph.

The name *Macropus titan* was established by Owen on portion of the right ramus of the mandible of a young animal with mutilated m_1 and m_2 and p_4 (*in alveolo*). Subsequently he described a number of specimens, chiefly from Queensland localities, including a fine skull from King's Creek, Darling Downs,[5] which he assigned

[2] Owen.—Phil. Trans., clxiv, 1874, p. 252; Extinct Mamms. Australia, p. 404 (London, 1877).
[3] Ramsay.—Exploration of the Caves and Rivers of N. S. Wales, p. 45 (N. S Wales Votes and Proceedings, 1882, v, pp. 551-602).
[4] Owen.—Phil. Trans., clxiv, 1874, p. 254; Extinct Mamms Australia, p 405-6.
[5] Owen—Phil. Trans., clxvi, 1876, pp. 204-209; Extinct Mamms. of Australia, pp. 435-439 (London, 1877).

to this species. The late C. W. De Vis held the view that the Queensland specimens described by Owen under this name are not conspecific with the Wellington Caves form, and for them he proposed the new specific name *Macropus magister*.[6] He based his argument chiefly on the ratio of breadth to length of the lower molars, but he seems to have overlooked the fact that in the type specimen, now in the British Museum, the two molars are both incomplete, m_1 lacking the front loph and m_2 part of the hind loph, so that his comparative measurements are unreliable. By the courtesy of Mr. H. A. Longman, Director of the Queensland Museum, I have been enabled to examine a number of maxillary and mandibular fragments identified by De Vis as *Macropus magister*, and after careful comparison and a study of Owen's descriptions and figures, I find that *M. magister* agrees in all essential features with *M. titan*. As Owen had for examination a part of an upper jaw accompanied by an almost entire lower jaw, apparently of the same individual,[7] there is no good reason for doubting the correctness of his identifications and association of maxillary with mandibular teeth, which moreover were accepted by Lydekker when preparing his catalogue.

At my request Mr. A. T. Hopwood, Geology Department, British Museum, examined the type of *Macropus titan*, and estimates that the width of m_2 is 64 per cent. of its length, while in other mandibular specimens relegated by Owen to this form the

	I.	II.	III.	IV	V.	VI.	VII.
Zygomatic breadth ..	101·5	64·7	130·0	102·0	—	—	—
Inter-temporal breadth ..	32·7	18·2	31·0	—	—	—	—
Palatal breadth outside m^1	51·0	32·0	58·0	47·5	—	—	—
Palatal breadth outside m^3	—	—	63·6	52·2	—	—	—
Diastema..	48·0	19·0	—	56·8	—	—	—
p^3	10·1 × 7·6	7·5 × 4·3	—	—	—	10·2 × 6·7	—
mp^4	12·3 × 9·2	8·0 × 6·0	—	—	—	11·2 × 9·2	—
p^4	11·1 × 6·5	8·3 × 4·0	9·5 × 5·4	8·0 × 5·0	9·3 × 6·0	11·2 × 5·6	9·2 × 5·2
m^1	14·8 × 10·5	9·3 × 7·0	12·5 × 9·7	9·1 × 8·0	12·0 × 9·5	13·8 × 10·5	12·0 × 8·9
m^2	—	—	15·1 × 11·5	11·2 × 9·3	14·1 × 11·1	15·6 × 12·2	14·0 × 10·5
m^3	—	—	15·5 × 12·5	12·7 × 9·4	14·8 × 11·8	17·0 × 13·0	14·6 × 11·0
m^4	—	—	16·1 × 12·1	13·5 × 10·0	16·6 × 11·9	—	15·0 × 11·0
m^1–m^3 ..	—	—	43·1	33·0	40·9	46·1	40·6
Foramen incisivum	12·0	8·3	—	10·2	—	—	—

I. ***Macropus titan***, juvenile, Wellington Caves (F.18665).
II. ***Macropus robustus***, approximately same age as F.18665.
III. ***Macropus titan***, Wellington Caves (F.7278).
IV. ***Macropus giganteus***, approximately same age as F.7273.
V. ***Macropus titan***, Wellington Caves (F.20886).
VI. ***Macropus titan***, Wellington Caves (F.20887).
VII. ***Macropus magister*** (= ***M. titan***), Darling Downs, Queensland (F.19646).

[6] De Vis.—Proc. Linn. Soc. N. S. Wales, x, 1894, p. 120.
[7] Owen.—Phil. Trans., clxiv, 1874, p. 253; Extinct Mamms. of Australia, p. 405.

mean percentage is 63. In *M. magister*, according to De Vis, the mean ratio of length to breadth in m_2 is 100:62. Mr. Hopwood, to whom I am greatly indebted for the trouble he has taken, agrees with me that *M. magister* is a synonym of *M. titan*.

This large extinct kangaroo, which considerably exceeded any existing species in size, belongs to the small-premolared group, and in its skull characters and dentition it most resembles *Macropus giganteus*, as has already been pointed out by McCoy[8] and Lydekker.[9] Its molars are slightly more complicated in structure than those of the latter, and it does not seem that the two species "pass imperceptibly into one another," or that *M. giganteus* is a direct descendant of *M. titan*. It was one of the commonest species in the Pleistocene period, and widely distributed on the Australian continent, for it has been found in various localities in Queensland, New South Wales, and Victoria, and has also been recorded from Western Australia.[10]

Genus THYLACOLEO *Owen*.

Thylacoleo Owen, *in* Gervais' Zool. et Pal. franc., 1st Edit., 1849-1852, pt. 1, p. 192; Proc. R. Soc., ix, 1858, p. 585.

Schizodon Stutchbury, Parl. Blue Book, Dec., 1854, p. 52.

Thylacopardus Owen, Proc. R. Soc. xlv, 1888, p. 99 (*nom. nud.*).

Id. Trouessart, Cat. Mamm. tam. Viv. quam Foss., nov. Edit., ii, 1898-1899, p. 1156. *Id.* Zittel, Handb. d. Pal., iv, 1891-1893, p. 110.

THYLACOLEO CARNIFEX *Owen*.

(Pls. xix-xxiii.)

Thylacoleo carnifex Owen, Proc. R. Soc., ix, 1858, p. 585; Phil. Trans., cxlix, 1859, p. 309; Extinct Mamms. Austr., p. 107 (London, 1877). *Id.* Lydekker, Brit. Mus. Cat. Foss. Mamms., pt. v, 1887, p. 189.

Thylacoleo oweni McCoy, Prodromus Palæont. Vict., Decade iii, 1876, p. 9.

Thylacopardus australis Owen, Proc. R. Soc. xlv, 1888, p. 99 (*nom. nud*).

Few mammals living or fossil have excited more interest and discussion than the so-called Marsupial Lion, both as regards its affinities and its food habits. Broom[11] has given an excellent sum-

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[8] McCoy.—Prodromus Palæont. Vict., Decade vi, 1879, p. 6.
[9] Lydekker.—Brit. Mus Cat. Foss. Mamms., Part v, 1887, pp 225-6
[10] Glauert.—Rec. West. Aus. Mus, i, 2, 1912, p. 61.
[11] Broom.—Proc. Linn. Soc. N. S Wales, xxiv, 1898, pp. 57-74

mary of the stages by which our present knowledge of this animal has been attained, and it is not necessary to traverse the ground again. Briefly, it may be stated that *Thylacoleo* is now generally placed in a sub-family Thylacoleoninæ of the family Phalangeridæ,[12] or in a separate family Thylacoleontidæ,[13] though by Trouessart it is catalogued in a sub-family Thylacoleoninæ of the family Dasyuridæ.[14]

As regards its food habits the opinion has now gained ground, chiefly on account of the strong arguments advanced by Broom,[15] that Owen was right in regarding it as a carnivore. Marrett Tims and Hopewell-Smith, however, still hold that the balance of evidence is against Owen's view.[16] This question will be briefly discussed subsequently. Whether it is possible to recognise more than one species of *Thylacoleo* is doubtful. The type is the mutilated skull discovered at Lake Colungoolac, eighty miles south-west of Melbourne, by Mr. W. Adeney in 1846, and McCoy considered that this is distinct from the New South Wales and Queensland form, for which he proposes the specific designation *oweni*.[17] But the points of difference on which he relies (chiefly the size and form of the third maxillary tooth and the course of the premaxillo-maxillary suture) are not conclusive when comparison is made with Wellington Caves specimens in our collection. In view of our limited knowledge of possible variations due to sex and age, it seems preferable to include all the known specimens in the species *T. carnifex*.

In 1888 Owen communicated to the Royal Society a paper entitled "Description of the Skull of an Extinct Carnivorous Mammal of the Size of a Leopard (*Thylacopardus australis* Owen), from a recently opened Cave near the Wellington Caves Locality, New South Wales."[18] This paper was never published, but on communicating with Mr. F. A. Towle, Assistant Secretary of the Royal Society, I was informed that Owen's manuscript is still in existence, and that four plates had been prepared by Erxleben to illustrate the paper. I am extremely grateful to Mr. Towle and the Council of the Royal Society for the opportunity of obtaining and making use of a copy of Owen's manuscript, and photographic reproductions of Erxleben's drawings, which, like all that artist's work, are beautifully executed. The skull on which Owen's description was based is in the Mining and Geological Museum, Sydney, and by the kindness of the Under-Secretary for Mines, Mr. F. S. Mance, Trustee, and the Government Geologist, Mr. E. C. Andrews, Trustee,

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[12] Zittel.—Grundzüge d. Pal., Abt. ii, 1923, p. 435; Zittel-Eastman, Text-book Pal., iii, 1925, p. 29.

[13] Bensley.—Trans. Linn. Soc., Zool., ix, 1903, p. 203. Gregory.—Bull. Amer. Mus. Nat. Hist., xxvii, 1910, p. 217.

[14] Trouessart.—*Loc. cit.*, Suppl., 1904-1905, p. 846.

[15] Broom.—*Loc. cit.*

[16] Marrett Tims and Hopewell-Smith.—Tomes' Manual of Dental Anatomy, 7th Edit., 1914, p. 418.

[17] McCoy.—*Loc. cit.*

[18] Owen.—Proc. R. Soc., xlv, 1888, p. 99 (title only).

I have been permitted to obtain a loan of the specimen. I am indebted to Mr. W. S. Dun, Palæontologist, Geological Survey, New South Wales, for calling my attention to this fine skull and its history. This skull is briefly discussed below and Erxleben's drawings are reproduced (Pls. xix-xxii); I find that there is no good reason for regarding it as generically or specifically distinct from *Thylacoleo carnifex*.

One of the curiosities of zoological nomenclature is revealed by the history of a supposed marsupial fossil "*Thylacodes*," presumed to belong to the same family as *Thylacoleo*. In 1888, at a meeting of the Linnean Society of New South Wales, the late Dr. J. C. Cox exhibited "a Tertiary fossil from Wildhorse Plains, which he believed to be identical with *Thylacodes decussatus* Gm., a living Port Jackson species"; this name is synonymous with *Vermetus decussatus*, which is a marine mollusc. By some unfortunate mistake this note led to the tentative recognition of a new genus of fossil marsupial, ? *Thylacodes* Cox, which is listed in Roger's "Verzeichnis der bisher bekannten fossilen Säugetiere."[19] Trouessart places it with *Thylacoleo* in the family Phalangeridæ, sub-family Thylacoleontinae, and, in the supplement to his well-known catalogues, in the family Dasyuridæ.[20]

This peculiar mishap can be accounted for only by the similarity in the first part of the names *Thylacodes* and *Thylacoleo*, and the fact that both records are Australian. Trouessart naïvely states in a footnote, "Ce genre ne figure pas dans: Palmer, Index generum Mammalium (1904); c'est vraisemblablement un *nomen nudum*."

Cranial Osteology of Thylacoleo.

Owen in his several papers in the Philosophical Transactions, reproduced in his Extinct Mammals of Australia,[21] has discussed the skull and dentition of *Thylacoleo* at great length, and only a few details are now lacking. On our visit to the Wellington Caves, Mr. G. C. Clutton and myself were fortunate enough to obtain a fine skull, and, using this and other specimens contained in the Museum collection, Mr. J. Kingsley, Assistant Articulator, has prepared a model of the skull and mandible (pl. xxiii). In the course of the work some interesting points in the skull structure were discovered.

One feature in which *Thylacoleo* differs from all marsupials, recent or extinct, is the presence of a postorbital bar. In marsupials a slight postorbital process is sometimes present on the frontal, and, in the Polyprotodonts particularly, the malar also sends up a post-

[19] Roger.—Ber. d Naturw. Verh. f. Schwaben u Neuburg. 1896 (p. 9).
[20] Trouessart.—Cat. Mamm, ii, 1898-9, p. 1156, Suppl. 1904-5, p. 846.
[21] Owen.—Phil. Trans, cxlix, 1859, pp. 309-322; clvi, 1866, pp 73-82; clxi, 1871, pp 213-266; clxxviii, B, 1887, pp. 1-3; Extinct Mamms Austr, pp 107-188 (London, 1877).

orbital apophysis, but these are separated by a wide gap. In *Thylacoleo*, however, these two processes join to form a complete though rather slender bar. Gregory suggests that the prominent postorbital apophysis on the malar of carnivorous marsupials may possibly be a remnant of the postorbital bar in the Cynodonts.[22] In any case the presence of a complete postorbital bar in *Thylacoleo* emphasizes the aberrant character of the animal. Whether it has preserved a feature which was present in ancestral marsupials, or developed the bar since it branched off, one may judge that the *Thylacoleo* line has long been distinct, and that it has no close affinity with any existing family. Its resemblance to the Phalangeridæ is probably the result of convergence.

A striking feature of the skull, which has not been alluded to by previous writers, is the large opening in the region of the spheno-palatine foramen, due to which there is wide communication between the orbito-temporal fossa and the nasal cavity. This opening is oval in shape, the long axis approximately parallel to the long axis of the skull, and it measures as much as 27 × 15 mm. in a medium-sized skull; in a large tiger, in which the skull is about twice the size of that of *Thylacoleo*, the spheno-palatine foramen is no more than 10 mm. in greatest diameter. In *Thylacoleo* the lower margin of this opening forms the lateral boundary of the posterior palatal vacuity, so that these two openings may be described as confluent. In no land mammal with which I am acquainted is the spheno-palatine foramen so large relatively as it is in this marsupial, though in the sheep and certain other ruminants it attains a considerable size. In the Pinnipedia, however, there is a large vacuity in this region. I am unable to suggest what may be the significance, if any, of the unusually large size of this opening in *Thylacoleo*.

In marsupials generally the optic and anterior lacerate (sphenorbital) foramina are not separated, and the opposite sphenoptic foramina (using the term suggested by Kesteven[23]) are confluent, so that at this point a bristle may be passed through the skull perpendicular to the sagittal plane. In *Macropus* and most diprotodonts the fissure formed by the confluent foramina is widely open, but in polyprotodonts and *Phascolarctos* it is much smaller, a mere slit in the median septum. In *Thylacoleo*, so far as can be judged from the specimens available to me, either the opposite sphenoptic foramina are not confluent, each running backward separately to open into a common fossa in the brain cavity, or the fissure uniting them is very small.

The "transverse canal," which tunnels the basisphenoid a little in advance of the entocarotid foramen, is well developed and sends

[22] Gregory.—Bull. Amer. Mus. Nat. Hist., xxvii, 1910, p. 220.
[23] Kesteven.—Jour. Anat., lii, 1918, p. 466.

off a branch on each side, which runs forward to emerge in the foramen rotundum. This transverse canal is poorly developed or even absent in diprotodonts, but is prominent in polyprotodonts, particularly in *Thylacinus*, in which the forwardly running branch leads, not to the foramen rotundum as in *Thylacoleo*, but to the sphenoptic fissure.

The mode of articulation of the lower jaw is of great importance from the point of view of food habits, the features characteristic of flesh-eaters and of vegetable-feeders being well known. In *Thylacoleo* the condyle is low, being about on a level with the cutting edge of the large premolar, and it is without neck. It is transversely elongated, the longer half on the lateral side of the ramus. The articulating surface faces upwards, not backwards as in typical carnivores. The glenoid facet is convex downwards in fore and aft direction (the skull being held in the natural position), and is not a transverse hollow but extends some distance forwards. Apparently the mandible was capable of some degree of propalinal motion and of some rotation as well, though lateral movement of the jaws can not have been very extensive. The post-glenoid process is a comparatively weak structure, thin and almost scroll-like, its lower edge curving over the auditory meatus; apparently it was co-ossified with the tympanic ring.

The dentition has been so fully described by Owen that a brief outline only will be given here. The front incisors in the upper jaw are large, tusk-like, blunt, and somewhat procumbent, separated at their bases and approximated at the tips. A facet of wear soon develops on the tip, and the lower incisor scores a vertical groove on the postero-internal surface, indicating that the lower teeth pass inside the upper. There is no interlocking of the upper median incisors and the lower incisors, which Owen regarded as the grasping and piercing teeth, corresponding to the canines of placental carnivores and marsupial carnivores of the ordinary type. It seems that as the jaws closed the mandible moved backwards slightly. The two succeeding incisors, the canines, and the two fore most premolars of the upper jaw are of relatively small size, trenchant or pointed when unworn, but becoming blunted later, so that they evidently served some useful purpose. The fourth (or it may be the third) upper premolar is an enormous blade-like tooth, with a fore and aft length of as much as 5 cm. For about two thirds of its length its cutting edge is practically straight, but the posterior third takes a pronounced bend outwards. This edge is irregularly concave and the medial margin becomes abraded by attrition against the outer margin of the similar lower premolar, which develops a corresponding facet of wear. This shows that the two large premolars, above and below, acted exactly like a pair of shears, the lower passing inside the upper, mutual attrition maintaining a chisel edge on both throughout life or until extreme old age. Succeeding the trenchant premolar in the upper jaw is a

tubercular molar, the crown much lower than that of pm^4; it is placed medial to the posterior end of that tooth, the long axis of its occlusal surface almost at right angles to the long axis of the latter. It evidently acted partly as a stop for the large lower premolar.

The pair of lower incisors are placed close together in the middle line, their medial surfaces in contact for their entire length so that they presented practically a single point. They sweep upwards in a gentle curve, their long axis having an angle of about 125° to the axis of the mandible. They are more pointed than the median upper incisors, although they become blunted with use. Close behind the incisors are two small rounded premolars, situated medially to the large premolar and apparently functionless. The fourth premolar in the mandible resembles the corresponding tooth in the maxilla, but it is shorter antero-posteriorly, measuring about 3·8 cm. in this direction. Its cutting edge curves regularly in the antero-posterior direction, the concavity being on the lingual side, and it has also a downward concavity. Behind this tooth are two molars, the first fairly large, the anterior part of its crown as high as that of the trenchant premolar, but sloping posteriorly; its edge forms a continuation of that of pm_4, making this tooth about equal in length to the corresponding upper premolar. The second molar, which is separated from m_1 by a slight interval, is small and pointed.

A cast of the brain cavity of *Thylacoleo* has been described by Gervais,[24] who found that in its cerebral form it closely resembles the wombats and differs from the macropods, phalangers, and dasyures.

Food Habits.

Thylacoleo has been regarded as a carnivore (Owen,[25] Broom[26]), an egg-eater (Cope[27]), a gnawer of bones (De Vis,[28] W. Anderson,[29] Spencer and Walcott,[30] Glauert[31]), and as a vegetable feeder, which might on occasions devour a bird or a small mammal (Krefft,[32] Flower,[33] Lydekker[34]). Bensley[35] and Abel[36] are of opinion that

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[24] Gervais.—Nouvelles Arch. Mus. d'Hist. Nat. Paris, v, 1869, pp. 236-237, pl. xiv, fig. 1.

[25] Owen.—Phil. Trans., cxlix, 1859, pp. 309-322; clvi, 1866, pp. 73-82; clxi, 1871, pp. 213-266; clxxiv, 1883, pp. 575-582; clxxviii, B, 1887, pp. 1-3; Extinct Mamms. Austr., pp. 107-188 (London, Erxleben, 1877).

[26] Broom.—Proc. Linn. Soc. N. S. Wales, xxiii, 1898, pp. 57-74.

[27] Cope.—Amer. Nat., xvi, 1882, pp. 521-2; xviii, 1884, pp. 696-7.

[28] De Vis.—Proc. Linn. Soc. N. S. Wales, viii, 1883, pp. 187-190; Proc. Roy. Soc. Vict., xii, 1, 1899, pp. 83-4; Ann. Q'land Mus., 5, 1900, pp. 7-11.

[29] Anderson (W.).—Rec. Geol. Surv. N. S. Wales, i, 2, 1899, pp. 122-3.

[30] Spencer and Walcott.—Proc. Roy. Soc. Vict., xxiv, 1911, pp. 92-123.

[31] Glauert.—Rec. West. Austr. Mus., i, 2, 1912, pp. 55-60.

[32] Krefft.—Ann. Mag. Nat. Hist., (3), xviii, 1866, p. 148; (4), x, 1872, pp. 169-182; Trans. Roy. Soc. N. S. Wales, 1873, p. 138.

[33] Flower.—Quart. Journ. Geol. Soc., xxiv, 1868, pp. 307-319.

[34] Lydekker.—*In* Nicholson and Lydekker, Manual of Palæontology, ii, 1889, p. 1285; Royal Nat. Hist., iii, 1894, p. 264; Allen's Naturalists' Library (Marsupials and Monotremes), 1894, p. 260.

[35] Bensley.—Trans. Linn. Soc., (2), Zool., ix, 3, 1903, pp. 161-2, 203.

[36] Abel.—Palæobiologie, p. 502 (Stuttgart, 1911).

Thylacoleo, from the omnivorous stage, had proceeded some distance along the evolutionary path leading to herbivority but reverted to a flesh diet, and, as its canines had already become so reduced that they were no longer capable of being utilised or modified as grasping and lacerating teeth, the incisors took on this function; in fact that *Thylacoleo* affords an example of the operation of Dollo's law.

Where opinions are so diverse, a natural deduction is that the available evidence is insufficient or conflicting, and it is probable that until additional material is procured, for example, limb bones undoubtedly thylacolean, the wisest course is to suspend judgment. A few points, however, which have a bearing on this question may be discussed here.

Cope's suggestion, that *Thylacoleo* subsisted on eggs, may, I think, be dismissed. It is difficult to see why an egg-eater should be provided with such large and trenchant premolars. Nor does the hypothesis that it was a sort of marsupial hyæna commend itself, although several writers have described fossil bones which exhibit what they suppose to be tooth marks of *Thylacoleo.* An animal adapted for a bone diet has broad strong teeth with several cusps, and a well developed cingulum on the molars and premolars, the purpose of which is to protect the gums from injury by splinters of bone. The teeth of *Thylacoleo* are not of this type; nor is such a cingulum to be found on them.

If Bensley and Abel are right in their interpretation of the dentition of *Thylacoleo,* we should find in its skull and teeth a number of characters recalling its incipient herbivority, overlain by features imposed by its later developed carnivority, and, if it was the fell and destructive beast that Owen pictured it, its flesh eating and predatory character should be unmistakable. In some respects, however, *Thylacoleo* was but poorly equipped for killing and devouring animals, at any rate animals of a size at all approaching its own.

The median incisors of the upper jaw were blunt tusks rather than piercing implements, they early developed signs of wear, and there was no interlocking of upper and lower incisors to enable the animal to get a firm and deadly grip of its prey. The upper median incisors were slightly procumbent and met the lower pair at an angle approaching 90°. We should expect that in an efficient carnivore the upper and lower grasping and piercing teeth would have their long axes approximately parallel. It is to be noted that there is a resemblance between the upper median and the lower incisors of *Thylacoleo* and *Nototherium,* in which these teeth are tusk-like and meet at approximately the same angles as do those of *Thylacoleo.* In *Procoptodon,* an extinct genus of the family *Macropodidæ,* the lower incisors incline upwards at an angle of about 135°, and are of a pointed piercing type; the upper incisors of *Procoptodon* seem to be unknown.

Nor did *Thylacoleo* possess a convenient provision for removing the flesh of its victim. Typical placental and marsupial carnivores are provided with transverse incisor rows above and below, which enable them to tear the flesh from their prey, but *Thylacoleo* had no teeth adapted for this purpose.

Owen emphasized the low position of the mandibular condyle and its sessile condition. But this is a primitive character, and, moreover, some undoubtedly vegetarian marsupials, such as *Petaurus breviceps* and *Potorous tridactylus* also have a relatively low condyle without neck. The shape of the condyle and of the glenoid facet in *Thylacoleo* (Pl. xxi, fig. 1, *g*) is not at all what we should expect in an habitually carnivorous animal, and recalls that of certain phalangers such as *Trichosurus vulpecula* amongst living marsupials.

The evidence to be derived from the muscular system, so far as that may be reconstructed from a study of the cranial and mandibular osteology, is conflicting. It is evident that in *Thylacoleo*, as in typical carnivores, the temporal muscle was large and powerful, as Broom maintains, although even in old animals the lambdoidal and sagittal crests are only of moderate size and in younger examples are practically absent. The masseter, judging by its impression on the zygoma, was not a large muscle, as we should expect in a vegetable feeder. On the other hand, the pterygoids were apparently well developed, as indicated by the long pterygoid crest and the strongly inflected angle of the jaw, which forms a broad shelf with a deep depression on its upper surface. Powerful pterygoids suggest that the mandible was capable of lateral and rotational movements, and are characteristic of phytophagous animals.

The zygomatic arches are wide and strong, but this, as Osborn[37] points out, is no proof of carnivorous habits, and it is well known that in the Nototheres, particularly Euryzygoma,[38] there is an enormous expansion of the zygomatic arches.

The absence of effective grinding teeth is the strongest argument against the view that *Thylacoleo* was a herbivore; it is obvious that it did not live on grass, roots, leaves, or any ordinary vegetable food. Are we then driven to the conclusion that it was a carnivore, or is it possible that it subsisted on some unusual type of vegetable food? Is it not possible that its food consisted of some sort of vegetable or fruit with a tough hard rind, which would be cut by the enlarged blade-like premolars, and a soft pulpy interior which did not require mastication? I have made inquiries from Mr. Edwin Cheel, of the Botanic Gardens, Sydney, who has an intimate knowledge of Australian plants, whether there is at the present time any plant of

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[37] Osborn.—Amer Nat., xxxiii, 1899, pp 174-5
[38] Longman.—Mem. Q'land Mus., vii, 12, 1921, pp. 65-80.

this kind widely distributed in Australia and occurring in sufficient quantity to render plausible the supposition that *Thylacoleo* may have been able to obtain an adequate supply. One may be justified in assuming that in Pleistocene times, when *Thylacoleo* lived, the general character of Australian vegetation was not greatly different from what it is now. He suggests that possibly the members of the family *Cucurbitaceæ* might fulfil requirements. There are several species of the cucumber family indigenous to Australia, and the fruit of some kinds is of fair dimensions, up to two and a half or three inches in diameter, with a hard rind and succulent interior. The seeds, which have a high food value, may well have been swallowed without mastication. The fruit, according to Mr. Cheel, lies on the ground for months, and it is conceivable that *Thylacoleo* may have been able to obtain a sufficient quantity all the year round. We may suppose that the front incisors were employed to pick the fruit, that the small teeth between these and the large premolars were used to hold it, that it was then passed back to the sectorial premolars by which the rind would be cut so that the contents might be utilized. It is also possible that *Thylacoleo* fed on the starchy pith of certain cycads, such as *Zamia* and *Macrozamia*, which would be cut into chunks by the large premolars and swallowed practically without mastication.

It is realised that this suggestion is no more than tentative, and that there are difficulties in accepting the view that *Thylacoleo* could obtain an adequate food supply from these sources.

"THYLACOPARDUS AUSTRALIS."

(Pls. xix-xxii.)

From Owen's manuscript we learn that this skull was discovered in "a small cave near Mitchell's 'Breccia Cavern,' 100 feet below the surface in Wellington Valley. A shaft had been sunk which led to the discovery of a series of small caverns, which were reached at a depth of 83 feet below its present surface." In describing it he says: "It is the skull, lacking the lower jaw, but with the teeth of the upper jaw characteristic of the genus *Thylacoleo*, but differing in size from those figured in Plates xvi and xvii of the work above quoted,[39] and with the addition of a small molar or molariform prominence (Pl. xxi, fig. 1, *m*) in a position which justifies a generic distinction, the dentinal structure being demonstrated. I have been favoured with the loan of the original specimen, with permission to make the section requisite for demonstration of the structure."

Examination of the specimen and the figure shows conclusively that "the small molar or molariform prominence" is merely the

[39] Owen.—Extinct Mamms Australia (London, 1877).

truncated end of the bar which bounds the posterior palatal vacuity behind. In *Thylacoleo* as in *Phascolarctos* and *Phascolomys* this bar is slender; it is seldom preserved unbroken, and in no specimen that I have seen is there any indication of a septum dividing the palatal vacuity into two halves, though it is probable that it was so divided. When the post-palatal bar is broken the two lateral ends are left as small processes, but it is surprising to find that Owen could have mistaken these for dentinal structures.

Owen is justified in calling attention to the relatively small size of the skull. He gives a table of measurements, comparing the dimensions of this specimen and of a skull of *Thylacoleo carnifex*, evidently that from the Condamine River, Queensland.[40] This table is copied below, inches and lines being converted into millimetres.

	"*Thylacopardus*."	*Thylacoleo carnifex*.
Length from occipital condyles to the fore part of the sockets of the front incisors	168	248
Length of the facial part anterior to orbit ..	64	77
Breadth across zygomata	154	205
Length of temporal vacuities	60	92
Length of alveolar series in a straight line ..	77	103
Breadth of bony palate at fore part of palato-nares	73	90
Breadth of the pair of palatal vacuities ..	47	56
From occipital crest to postorbital process ..	81	128
Vertical diameter of orbit..	38	45
Breadth across paroccipital processes	72	128

These figures establish a considerable discrepancy in size, but it seems probable that *"Thylacopardus"* was a young individual, the trenchant premolar showing but little wear. If Owen had measured the premolars, which do not vary in size with age, he would probably not have stressed the differences in size between his supposed new genus and *Thylacoleo carnifex*. In *"Thylacopardus"* these teeth measure in antero-posterior length at the base of the crown 50·75 mm., and their greatest thickness is 15·5 mm.; in three other skulls of considerably larger dimensions these measurements are respectively 49·8, 50·35, 50·65 and 15·8, 15·25, 15·3, showing the essential agreement in the four specimens.

As therefore, apart from its smaller dimensions, Owen's *"Thylacopardus"* exhibits no features which distinguish it from *Thylacoleo carnifex*, I have little hesitation in including it in that species.

[40] Owen.—*Loc. cit.*, p. 123, pls. xvi-xviii.

SUMMARY.

A skull of *Macropus titan* Owen, recently discovered at the Wellington Caves, N. S. Wales, is described, and some additional data are given regarding its cranial osteology and dentition. *Macropus magister* De Vis is shown to be a synonym of *M. titan*.

Some notes are given on the skull and dentition of *Thylacoleo carnifex* Owen, and its food habits are briefly discussed. It is shown that the animal was not well equipped for a flesh diet, and the tentative suggestion is made that it may have fed on some such vegetation as the fruit of the *Cucurbitaceæ*.

The type of *Thylacopardus australis* Owen (*nom. nud.*) is examined, and that name is found to be a synonym of *Thylacoleo carnifex*.

It is pointed out that *Thylacodes decussatus*, which has been listed as an extinct marsupial allied to *Thylacoleo*, is a mollusc (= *Vermetus decussatus*).

THE ELSINORA METEORITE: A NEW CHONDRITE FROM NEW SOUTH WALES.

By

T. Hodge-Smith,

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(Plate xxiv.)

While I was in Broken Hill, New South Wales, during November, 1924, Dr. W. Macgillivray, whose kind hospitality I was at the time enjoying, showed me two specimens which have since proved to be parts of a meteoric stone. Both these specimens he very generously presented to the Museum, and supplied the following information in regard to their history.

"The meteorite was found by Mr. Jorgen Thue-Johnsen, a surveyor of the Public Works Department, when surveying a line on Elsinora Station about 10 miles south-east from Thurloo Downs Homestead, which is about forty-six miles north-west from Wanaaring Township on the Paroo River, New South Wales. It was the only stone in a sandy paddock and hence attracted attention. One of Johnsen's men broke it with a hammer, and the two pieces which he gave me [Dr. Macgillivray] were the largest fragments, as the whole stone was only about ten or twelve inches long and six inches in diameter. It was found in September, 1922."

The locality is latitude 29° 27′ south, longitude 143° 36′ east.

The weight of the two fragments is 1797 grammes, the smaller weighing 517 grammes and the larger 1280 grammes. The specific gravity of the smaller piece taken as a whole is 3·59 and that of the material taken for analysis 3·595.

Unfortunately no record has been kept of the external appearance of the aerolite. Only a relatively small portion of the dull black crust remains. It exhibits two distinct features, namely, broad shallow depressions varying from 15 mm. to 30 mm. in diameter, with a maximum depth of 5 mm., and very small pits. The arrangement of these small pits is not very clear at first sight, but on close examination it was found that they have a more or less regular arrangement, forming stream-lines on one side of the shallow depressions, while on the other side the formation is not nearly so well defined or else is entirely absent. Another portion of the crust is quite flat, without any broad, shallow depressions, and with relatively few small pits. It has a number of cracks, but it is impossible to say whether these were produced by the maltreatment it had received at the hands of Johnsen's men, or whether they were naturally formed.

The distribution of the nickel-iron through the mass is worthy of note. One piece of iron with the appearance of ordinary hoop iron is included. At first glance it would appear that this piece is foreign to the stone, suggesting that the aerolite had been impaled on a piece of hoop iron at the moment of reaching the earth, but as the metal is nickel-iron, there can be no doubt that it actually forms part of the stone. The nickel-iron sometimes occurs in veins through the stone, but more generally it is fairly evenly distributed throughout the mass, and is easily visible to the naked eye. However, on grinding for analysis, it was found that the material could be ground to a fine state with only one or two larger particles of metal. Obviously these visible grains of nickel-iron are either much fractured or made up of numerous smaller particles.

Under the microscope thin sections show a number of chrondules, which consist of either olivine or fibrous radiating enstatite. The groundmass consists of olivine and enstatite with nickel-iron fairly evenly distributed, minute grains of troilite, and felspar, which is for the most part untwinned. Extinction angles were of no value in determining the felspar. It had a lower refractive index than Canada balsam, indicating an acid plagioclase. From the chemical analysis it would appear to be oligoclase with the composition of Ab_{44} An_{10}. A colourless mineral with only feeble double refraction and a low refractive index is also present in the groundmass. The aerolite belongs to the veined grey chondrites (Cga) of Brezina's classification.

	Attracted.	Unattracted.	Bulk Analysis.	Molecular Ratio.
SiO_2	3·58	43·59	35·47	·591
Al_2O_3	—	2·76	2·02	·020
Fe_2O_3	—	0·22	0·17	·001
FeO	1·54	11·07	9·14	·127
MgO	3·56	27·59	25·21	·630
CaO	0·25	1·89	1·56	·028
Na_2O	—	1·03	0·82	·013
K_2O	—	0·01	0·01	·001
H_2O	—	0·52	0·41	—
TiO_2	—	0·07	0·05	·001
P_2O_5	Present	0·13	0·10	·001
Cr_2O_3	—	0·43	0·34	·002
MnO	—	0·08	0·07	·001
CuO	Present		Present	
FeS	1·02	5·74	4·78	—
Fe	71·24	4·62	18·23	—
Ni	5·20	0·33*	1·31	—
Co	0·08	—	0·02	—
Insoluble	13·34	—	—	—
	99·81	99·78	99·71	—

* Including any cobalt.

The bulk analysis is calculated from the other two.

For the purpose of analysis, a portion weighing approximately 11 grammes was chosen. Owing to the finely divided state of the nickel-iron, the separation of the material into attracted and unattracted parts presented some difficulty. A small electromagnet was found to be the most suitable apparatus to use in this case. The attracted portion weighed 2·1851 grammes, and the unattracted portion 8·5845 grammes. The method of analysis used is that described by G. T. Prior[1] and the results as shown in the preceding table were obtained.

The following is the mineral constitution of the stone as calculated from the bulk analysis:—

Orthoclase	0·56	
Albite	6·81	
Anorthite	1·67	
Felspar		9·04
$CaO.SiO_2$	2·20	
$MgO.SiO_2$	18·60	
$FeO.SiO_2$	1·72	
Bronzite		22·52
$2MgO.SiO_2$	31·08	
$2FeO.SiO_2$	11·22	
Olivine		42·30
Apatite		0·31
Chromite		0·45
Troilite		4·78
Magnetite		0·23
Ilmenite		0·15
Iron	18·23	
Nickel	1·31	
Cobalt	0·02	
Nickel-iron		19·56
Water		0·41
		99·75

From the above results it will be seen that this chondrite belongs to Group 2 (Cronstad type) of Prior's classification. The ratio of Fe to Ni in the nickel-iron is 13·7, and the ratio of MgO to FeO in the magnesium silicates is 5.

[1] Prior.—Mineralogical Magazine, xvii, 1913, pp. 24-25.

EXPLANATION OF PLATE I.

Aviculopecten extensus, sp. nov.

Headland, near Ulladulla, New South Wales.

Fig. 1. Internal cast of a right valve, showing portion of anterior ear sculpture of the left valve.

Fig. 2. Photo-micrograph of valve sculpture of Fig. 3, exhibiting primary costæ, with occasional intercalated secondary costæ.

Fig. 3. External impression of a right valve with a portion of the posterior ear missing. The sculpture on both the auricles and the body of the valve is seen to advantage.

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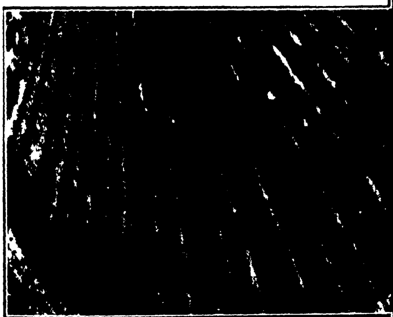

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G. C. Clutton, Photo.

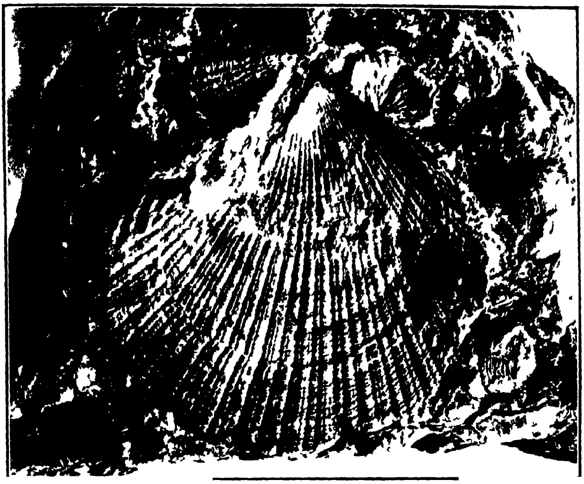
EXPLANATION OF PLATE II.

Aviculopecten multicostatus, sp. nov.

Fig. 1. External impression of a perfect right valve, exhibiting primary, secondary and tertiary costæ. The concentric growth lamellæ or frill imbrication is well defined on the body of the valve. St. George's Basin, New South Wales.

Fig. 2. A portion of a left valve of an immature specimen showing the ornamentation. Kangaroo Point, St. George's Basin, New South Wales.

Fig. 3. An external impression of a large left or convex valve with the posterior auricle missing. The byssal sinus separating the anterior auricle from the valve below is to be noted. Kangaroo Point, St. George's Basin, New South Wales.



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G. C. Clutton, Photo.

EXPLANATION OF PLATE IV.

Aviculopecten gracilis, sp. nov.

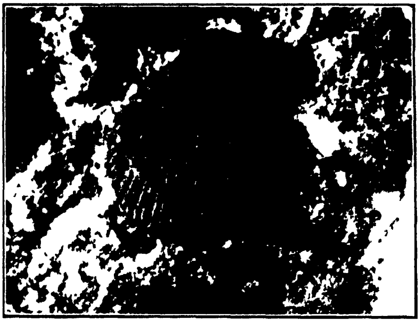
Fig. 1. External impression of a left valve with anterior ear preserved. North Head, Ulladulla, New South Wales.

Fig. 2. A left valve exhibiting convexity which is practically equal in both valves. North Head, Ulladulla, New South Wales.

Fig. 3. A photo-micrograph of a portion of Fig. 5 showing costæ which are all similar in size. Wyro, near Ulladulla, New South Wales.

Fig. 4. An external impression of Fig. 5. Wyro, near Ulladulla, New South Wales.

Fig. 5. A perfectly preserved left valve showing the relative proportions of the auricles and the shell ornamentation. Wyro, near Ulladulla, New South Wales.



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G. C. Clutton, Photo.

EXPLANATION OF PLATE V.

Aviculopecten parkesi, sp. nov.

Fig. 1. A right valve exhibiting strong convexity. The posterior ear is not preserved. Wyro, near Ulladulla, New South Wales.

Fig. 2. A left valve showing equal convexity with the right valve, and the very fine costæ with which the valve is ornamented. Wyro, near Ulladulla, New South Wales.

Fig. 3. An internal cast of a left valve, which exhibits the deep byssal sinus, which separates the anterior ear from the body of the valve. Wyro, near Ulladulla, New South Wales.

Deltopecten lata, sp. nov.

Fig. 4. A left valve in an almost perfect state of preservation. Maitland district, New South Wales.

Fig. 5. A right valve showing both the auricles and the valve ornamentation. North Head, Ulladulla, New South Wales.

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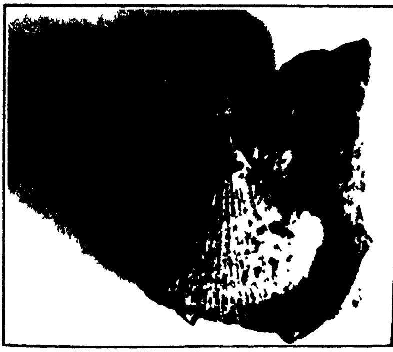

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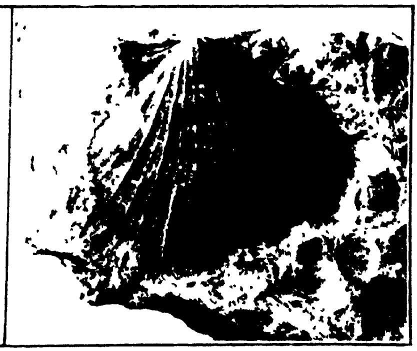

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G. C. Clutton, Photo.

EXPLANATION OF PLATE VI.

Deltopecten farleyensis, Eth. and Dun.

Fig. 1. An internal cast of a flattened right valve showing the extreme length of the dorsal margin in comparison with the height. The chondrophore pit is partly concealed. Jamberoo, New South Wales.

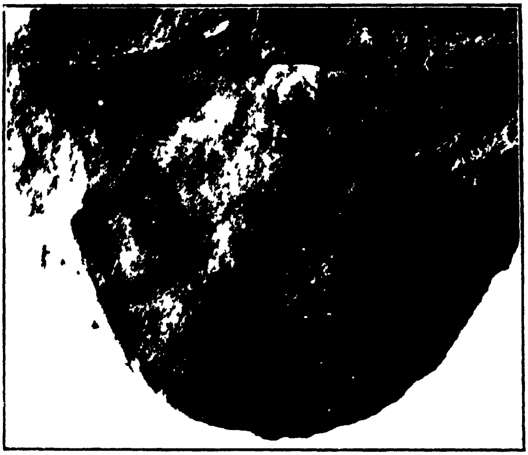
Aviculopecten englehardti, Eth. and Dun.

Fig. 2. An internal cast of a right valve showing obliquity, and the anterior auricle which is separated from the valve below by a deep byssal sinus; also an external impression of the left valve exhibiting the fine concentric markings of the valve. Ulladulla, New South Wales.

Fig. 3. An internal cast of a right valve showing the anterior auricle which is separated into two portions by a median depression. Wyro, near Ulladulla, New South Wales.

Deltopecten sp.

Fig. 4. An internal cast of a right valve showing chondrophore pit and the relative proportions of the auricles. The length of the lateral margins is well defined in this figure. Tianjarra, Wandrawandian Creek gullies, New South Wales.



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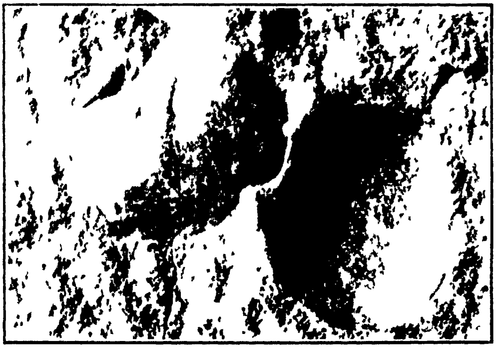

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G. C. Clutton, Photo.

EXPLANATION OF PLATE VII.

Deltopecten media (*Laseron*).

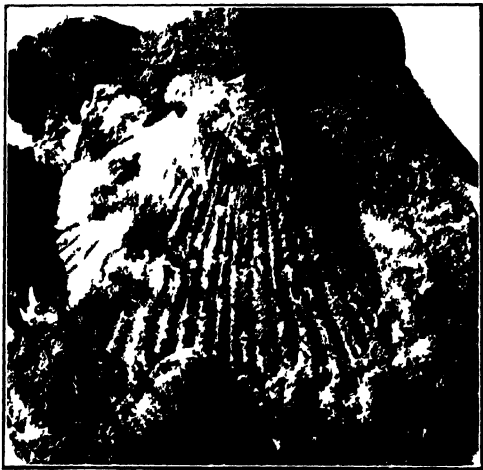
Fig. 1. An internal cast of a right valve, showing the valve sculpture. The relative proportions of the auricles are well defined in this figure, which also exhibits the byssal sinus and the chondrophore pit. Coast line between St. George's Basin and Ulladulla.

Fig. 2. Portion of a left valve showing the stronger convexity than the right. Wyro, near Ulladulla, New South Wales.

Fig. 3. The type specimen of *Aviculopecten media* Laseron. A left valve showing anterior auricle. Wandrawandian, New South Wales.

Fig. 4. An internal cast of a left valve exhibiting costæ. The chondrophore is just discernible. Coast line between St. George's Basin and Ulladulla, New South Wales.

Fig. 5. Internal cast of a left valve exhibiting portion of the hinge area of a right valve. Warden Head, Ulladulla, New South Wales.



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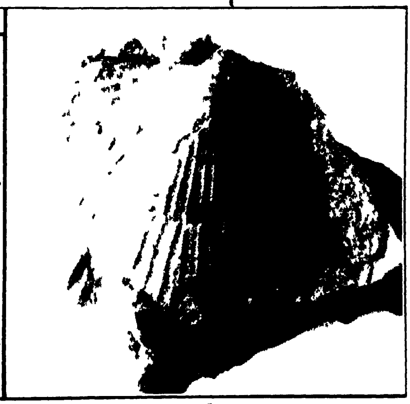

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G. C. Clutton, Photo.

EXPLANATION OF PLATE VIII.

Deltopecten fittoni (*Morris*).

Coast line between St. George's Basin and Ulladulla, New South Wales.

Fig. 1. A slightly oblique internal cast of a left valve, exhibiting hinge area and the chondrophore, which is partly concealed by the umbo.

Fig. 2. An external impression of a left valve, which shows to advantage the characteristic sculpture of this species.

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G. C. Clutton. Photo.

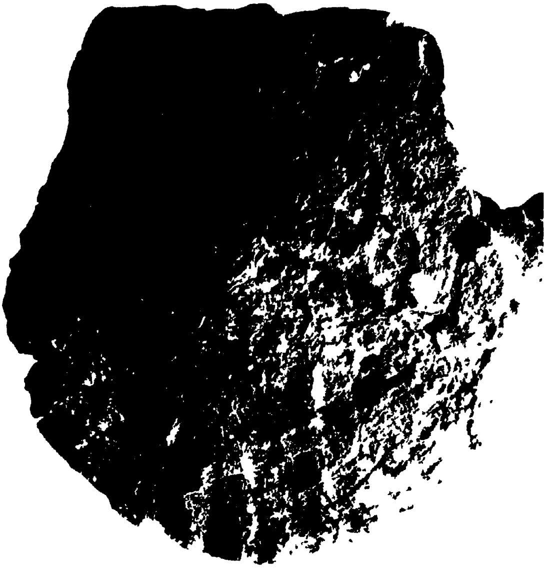
EXPLANATION OF PLATE IX.

Deltopecten depressus, sp. nov.

Kioloa, near Ulladulla, New South Wales.

Fig. 1. A large left valve of an adult specimen, showing the heavy folds and relative proportions of the auricles.

Fig. 2. An internal view of a left valve, showing the large chondrophore pit.



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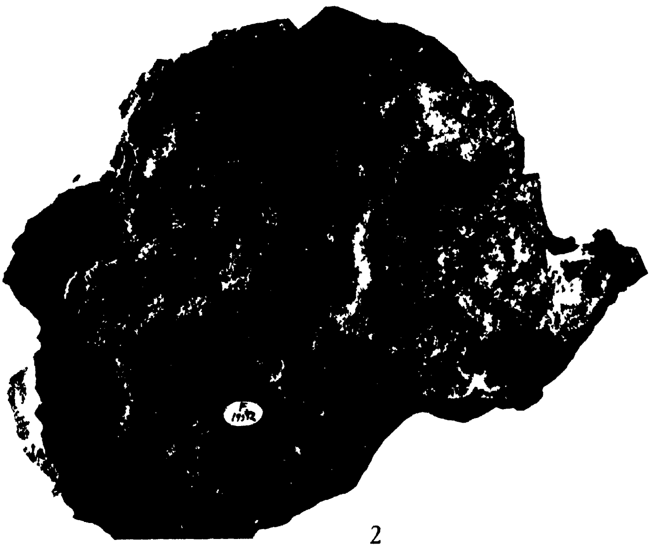

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G. C. Clutton, Photo.

EXPLANATION OF PLATE X.

Deltopecten depressus, sp. nov.

Kioloa, near Ulladulla, New South Wales.

Fig. 1. Portion of the very much flattened right valve, showing the posterior auricle and heavy valve sculpture.

Fig. 2. Left valve of an immature specimen, which exhibits the ornamentation (inferior in size to the adult) and the auricles.

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G. C. Clutton, Photo

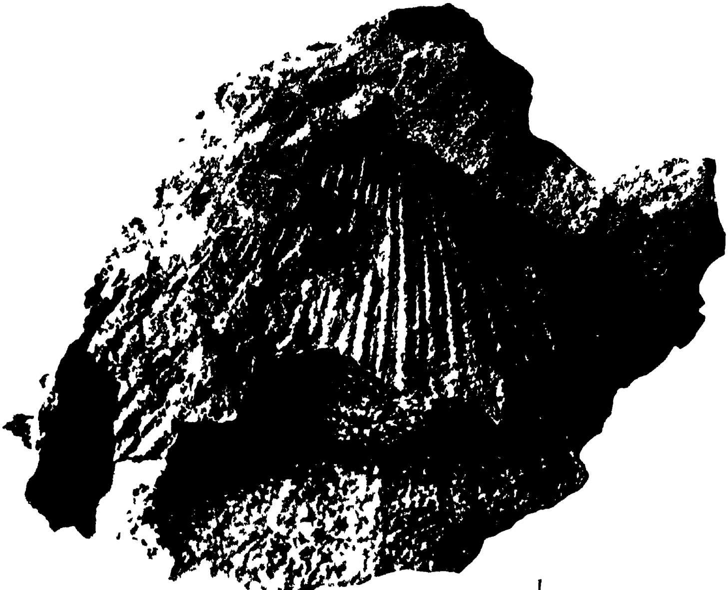
EXPLANATION OF PLATE XI.

Deltopecten cf. giganteus, Chao.

Kioloa, near Ulladulla, New South Wales.

Fig. 1. Portion of a left valve, showing the closely packed primary and secondary costæ.

Fig. 2. The right valve of Fig. 1, exhibiting the anterior auricle and valve sculpture. A portion of the hinge area and umbo of the left valve are visible.



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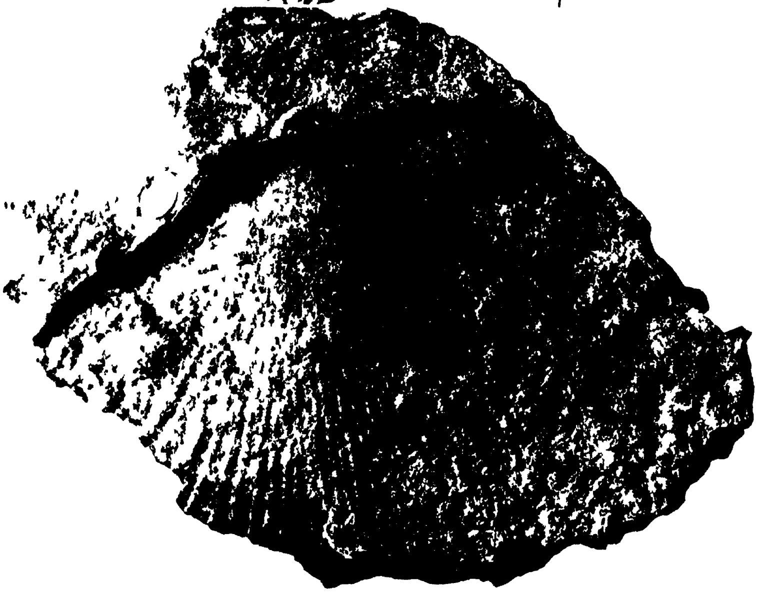

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G. C. Clutton Photo

EXPLANATION OF PLATE XII.

Deltopecten leniusculus (*Dana*).

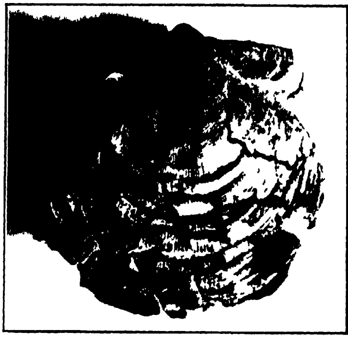
Fig. 1. A right valve exhibiting the valve ornamentation. Gerringong, New South Wales.

Fig. 2. An external impression of a right valve, showing relative proportions of the auricles. North Head, Ulladulla, New South Wales.

Fig. 3. An external impression of a left valve of a comparatively large specimen, showing the convexity and valve sculpture. Gerringong, New South Wales.

Fig. 4. The external impression of a right valve. North Head, Ulladulla, New South Wales.

Fig. 5. Photo-micrograph of a portion of a left valve showing (1) Primary and (2) Secondary costæ. Gerringong, New South Wales.



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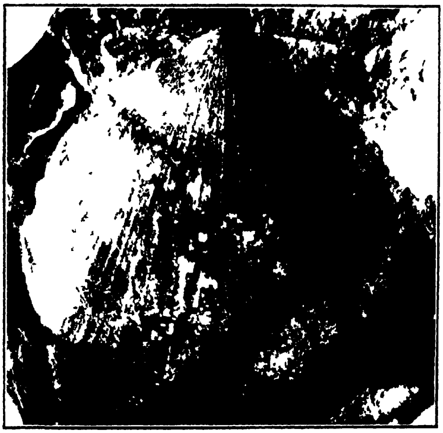

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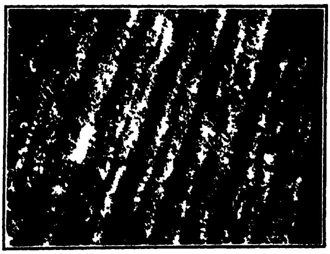

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G. C. Clutton, Photo.

EXPLANATION OF PLATE XIII.

Deltopecten comptus (Dana).

Fig. 1. Portion of a left valve, showing the relative proportions of the auricles and the heavy primary costæ. Tianjarra, Wandrawandian Creek, New South Wales.

Fig. 2. An external impression of a left valve. Lake Tullawalla, St. George's Basin, New South Wales.

Fig. 3. A cast of Dana's type specimen of *Pecten comptus*. Illawarra, New South Wales.

Fig. 4. A photo-micrograph of a portion of a left valve, showing (*a*) Primary, (*b*) Secondary, (*c*) Tertiary costæ.

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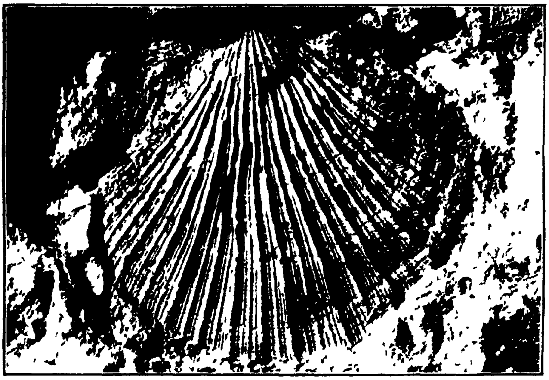

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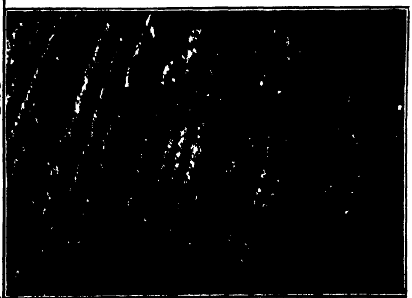

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G. C. Clutton, Photo.

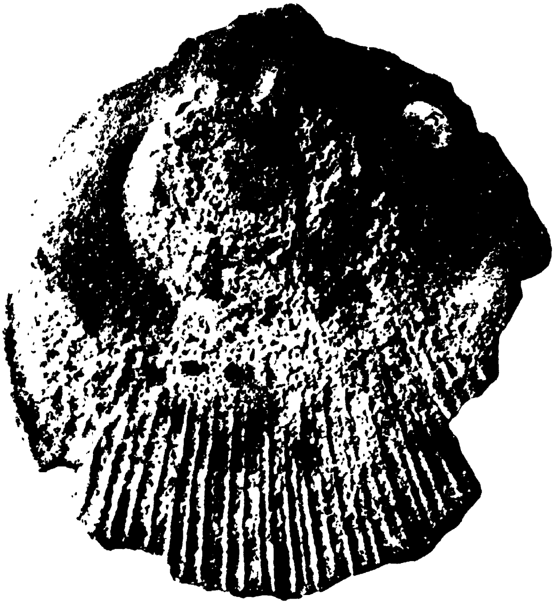
EXPLANATION OF PLATE XIV.

Deltopecten clarkei, sp. nov.

Sussex Inlet, New South Wales.

Fig. 1. Internal cast of a flattened right valve, exhibiting costæ of the one type.

Fig. 2. Internal cast of a convex left valve, showing a small portion of the posterior auricle.



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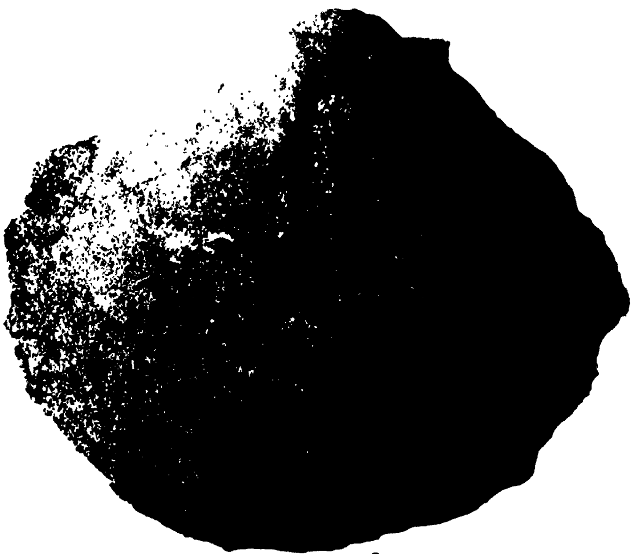

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G. C. Clutton, Photo.

EXPLANATION OF PLATE XV.

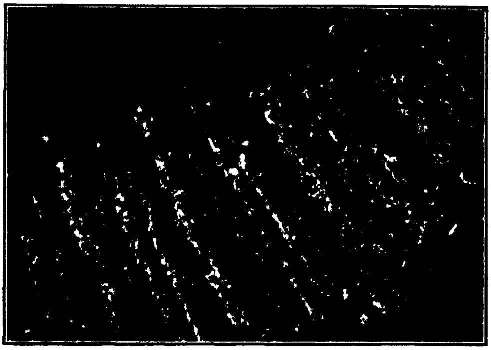
Deltopecten subquinquelineatus (*McCoy*).

Fig. 1. Photo-micrograph of a portion of a left valve, showing the (*a*) Primary, (*b*) Secondary and (*d*) Tertiary costæ.

Fig. 2. An internal cast of a left valve. Lake Tullawalla, St. George's Basin, New South Wales.

Fig. 3. A left valve, showing the relative proportions of the auricles. The chondrophore pit is partly concealed by the umbo. Conjola, near Milton, New South Wales.

Fig. 4. An external impression of a left valve. Both auricles are missing. Conjola, near Milton, New South Wales.



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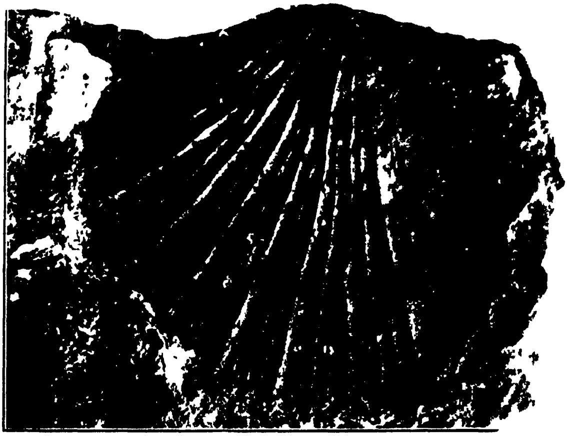

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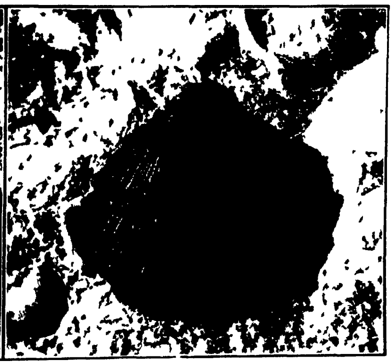

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G. C. Clutton, Photo.

EXPLANATION OF PLATE XVI.

Deltopecten subquinquelineatus (*McCoy*) *var. delicatula*, *var. nov.*

Fig. 1. A left valve, exhibiting the relative proportions of the auricles and the valve sculpture. Ulladulla, New South Wales.

Fig. 2. External impression of a left valve. North Head, Ulladulla, New South Wales.

Fig. 3. A photo micrograph of a portion of a left valve, showing (1) Primary and (2) Secondary costæ.

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G. C. Clutton, Photo.

EXPLANATION OF PLATE XVII.

Macropus titan Owen; skull, Wellington Caves, New South Wales. A.M. No. F.18665. In Fig. 1 the bone has been cut to expose the unerupted fourth premolar. In Fig. 3 × indicates the inter-alveolar foramen. Slightly more than half natural size.

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G. C. Clutton, photo

EXPLANATION OF PLATE XVIII.

Teeth of *Macropus titan* Owen.

Fig. 1. Right first molar, occlusal surface, inside of tooth to right.

Fig. 2. Right first molar, outside view.

Fig. 3. Right first molar, posterior view.

Fig. 4. Left third premolar, inside view.

Fig. 5. Left third premolar, occlusal surface, inside of tooth to left.

Fig. 6. Left fourth premolar, inside view.

Fig. 7. Left fourth premolar, occlusal surface, inside of tooth to left.

All figures × 4 natural size.

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Joyce K. Allan, del.

EXPLANATION OF PLATE XIX.

"*Thylacopardus australis*" Owen (= *Thylacoleo carnifex* Owen).
Skull, Wellington Caves, New South Wales. Natural size.

J Erxleben, del

EXPLANATION OF PLATE XX.

"Thylacopardus australis" Owen (= *Thylacoleo carnifex* Owen). Skull, top view. ¾ natural size approx.

J. Erxleben del.

EXPLANATION OF PLATE XXI.

"*Thylacopardus australis*" Owen (= *Thylacoleo carnifex* Owen). Skull, palatal view. The drawing is deceptive, as the palatal portion of maxilla appears to be on the same plane as the vomer, presphenoid and basisphenoid; *m*, *m* are the remains of the post-palatal bar, thought by Owen to represent a "small molar or molariform prominence." ¾ natural size approx.

J. Erxleben del.

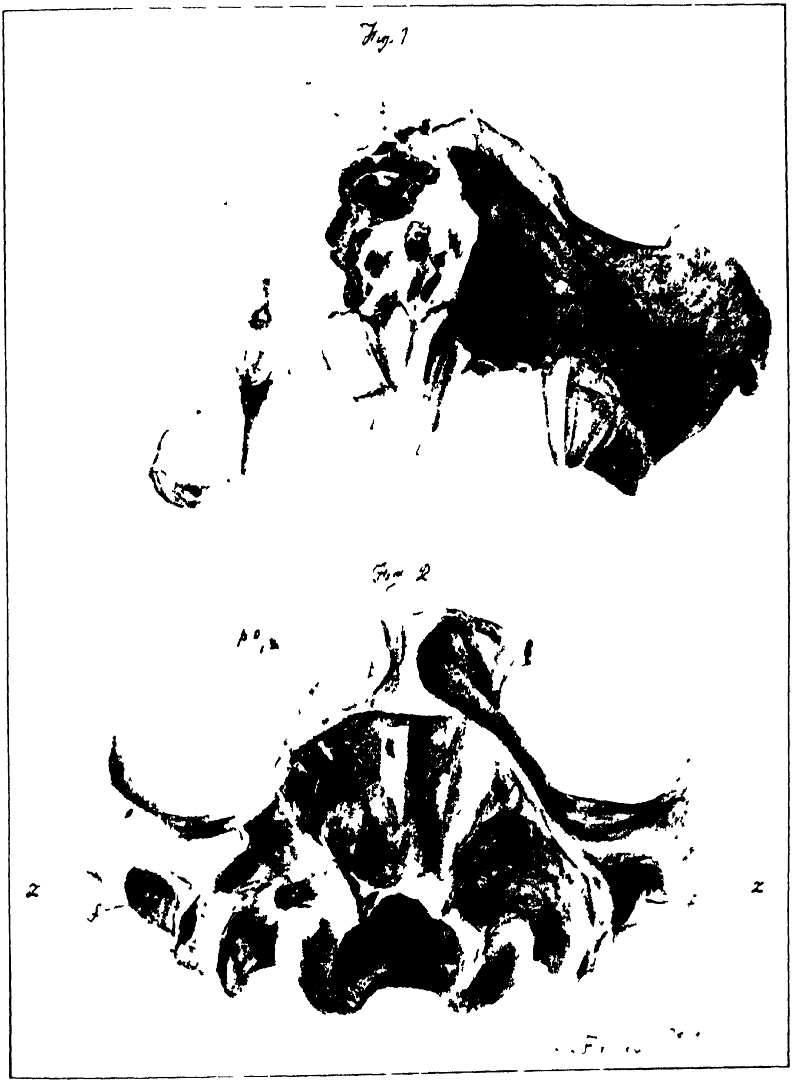
EXPLANATION OF PLATE XXII.

"*Thylacopardus australis*" Owen (= *Thylacoleo carnifex* Owen).

Fig. 1. **Skull, front view.**

Fig. 2. **Skull, back view.**

¾ natural size approx.



J. Erxleben, del.

EXPLANATION OF PLATE XXIII.

Thylacoleo carnifex Owen. Skull and mandible, from a model by J. Kingsley.

Fig. 1. Side view of skull and mandible; in the photograph, the lower incisors appear slightly more procumbent than they are in reality.

Fig. 2. Palatal view. The posterior palatal vacuity is shown as undivided; the septum is not preserved in any of the specimens examined, but there is little doubt that an undamaged skull would show a narrow bar dividing the vacuity into right and left halves.

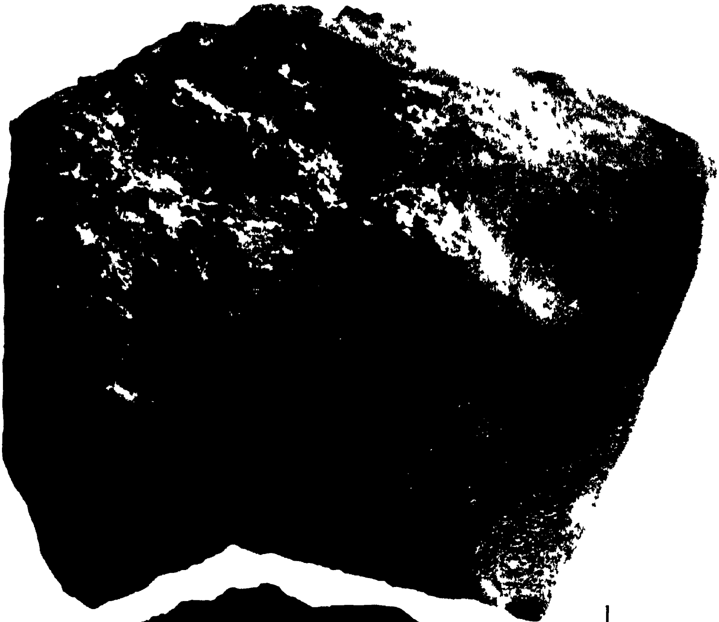
$\frac{3}{7}$ natural size approx.

G. C. Clutton, photo.

EXPLANATION OF PLATE XXIV.

Fig. 1. Elsinora meteorite, showing a vein of nickel-iron near the centre of the photograph.

Fig. 2. Another view of the same meteorite.
(Slightly larger than natural size.)



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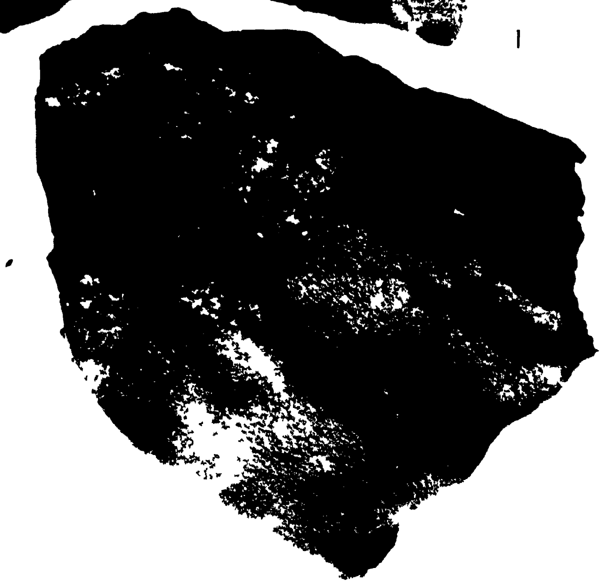

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G. C. Clutton, photo

A REVISION OF THE GENUS *ASTARTILA*.*

BY

HAROLD O. FLETCHER,
Assistant in Palæontology, The Australian Museum;

with an Introduction by W. S. DUN,
Palæontologist to the Geological Survey, and Lecturer
in Palæontology at the University of Sydney.

(Plates xxv-xxix.)

INTRODUCTION.

In his preliminary notes[1] on the fossils collected during the Wilkes Expedition, Dana gave specific descriptions of *Astartila intrepida* (which has to be regarded as the type species of the genus), *cyprina*, *cytherea*, *polita*, *transversa*, and *corpulenta*.

This species was separated from his *Astarte gemma* by being "more transverse and inequilateral than is characteristic of that genus, and the ligament is longer, occupying the whole cardinal area. The beak of an interior cast has the summit obliquely truncate, and the lateral surface just posterior to the middle is more or less flattened. The large muscular impressions are broad subelliptical or suborbicular, with the upper side often straight. The smaller anterior is situated under the beaks as in *Astarte*. The external surface is concentrically striate. The valves at middle are quite thin, hardly one-sixtieth of an inch in the first of the following species (*A. intrepida*), and they thicken below towards the margin, where the same species is half a line thick. Although we have not yet made out the teeth of the hinge, we propose to describe the species under the generic name *Astartila*."

He remarks that he has not seen teeth in *Astartila*, but (p. 154) he states "The impression of two divergent teeth is finely preserved."

In his completed memoir[2] he defines *Astartila* as "Equivalve, inequilateral, transverse, throughout convex, externally marked with concentric striæ. Ligament external, extending to the posterior extremity of the cardinal area; umbos of moderate size. Palleal

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* Unless otherwise designated, all specimens are from the Varney Parkes Collection.

1 Dana.—Amer. Jour. Sci., (4), ii, 1847, p. 155.

2 Dana.—U.S. Explor. Exped. during the years 1838-42 under the command of Charles Wilkes, U.S.N., Vol. x, Geology. Philadelphia, 1849.

impression entire. Muscles two anteriorly and one posteriorly; the smaller interior under the beaks, and directed inward; the larger broad, subelliptical, or suborbicular; the posterior also broad. Valves having the interior surface, from the umbos obliquely downward, flattened or a little raised (producing a flattened or excavate area on the lateral surface of a cast)."

He also says that "this genus has many of the characters belonging to *Astartc,* and perhaps should be considered as only a subgenus in that group. The form is more transverse; the beaks are more to one side, the anterior portion of the shell varying from one-quarter to two-fifths of the whole length; and the ligament is much longer. Besides the cast has the beak obliquely truncate at apex, and is flattened laterally on the side of the beak. There is usually one or two folds or lines extending from behind the beak obliquely downward, so as to pass near the anterior side of, or across, the posterior muscular impression. The valves are very thin at middle, being hardly one-sixtieth of an inch in the first of the following species (*A. intrepida*), and are thickened below towards the margin, a short distance from which the same species is half a line thick. The palleal impression stops abruptly just before reaching the posterior muscular impression. Our specimens show well the exterior and interior of different species; but the teeth of the hinge have not been made out. The exterior surface is unevenly marked with concentric striæ of growth, and is convex quite to the anterior margin."

In both the generic diagnosis and the descriptions of the species Dana makes no reference to the présence of teeth.

John Morris in 1845 described Strzelecki's collection from New South Wales[3] and proposed the genus *Pachydomus* for a series of forms which are now known to belong to several genera. His *Pachydomus* was to replace *Megadesmus* of Sowerby,[4] which is a toothed form. Sowerby remarks: "The teeth have hitherto only been observed in imperfect casts of some of the species, from which it would appear that the one in the left valve is the largest, and thickened posteriorly." The presence of teeth, therefore, takes this form away from the genus *Astartila.* The only other form figured by Sowerby[5] which may be an *Astartila* is that on plate x, fig. 4, which is not mentioned in the text.

At almost the same time McCoy described[6] specimens sent to Cambridge by W. B. Clarke. His descriptions were published in November, 1847, and he refers a number of specimens collected from Wollongong to *Pachydomus* of Morris, identifying his species and

[3] Strzelecki—Phys Descrip. of N.S.W. and Van Diem. Land, 1845, pp. 271-273.
[4] Mitchell—Three Exped. into Inter. of East. Aust., 1838, Vol. 1, p. 15.
[5] Strzelecki—Phys. Descrip. of N.S.W. and Van Diem. Land, 1845, pl x, fig. 4
[6] McCoy—Ann. Mag. Nat. Hist., Vol. xx, 1847, pp. 301-302.

perpetuating his nomenclature. Of these *Pachydomus* (? *pusillus* McCoy), pl. 16, figs. 1 and 2, and *Pachydomus ovalis* McCoy (pl. 14, fig. 4), are regarded as *Astartila,* and from his descriptions it is inferred that both these species are edentulous.

De Koninck[7] accepts *Pachydomus* for these shells, and describes and figures *Astartila polita* Dana as *Pachydomus* (pl. 19, figs. 4, 4*a*), and *Pachydomus danai* De Kon (pl. 19, figs. 5, 5*a*). Both these forms are from Wollongong, and from the figure the former is evidently toothless as well as Dana's *cyprina* (pl. 18, figs. 6, 6*a*) and McCoy's *ovalis* (pl. 19, fig. 3).

Stoliczka[8] takes *intrepida* as the type species of *Astartila* and separates it from *Pachydomus*, remarking that "the examination of the hinge-teeth is required for the correct determination of the family to which these shells belong."

Laseron[9] describes as *Astartila* (*Pachydomus* types A, B, C, and probably D). These are thick shelled forms and toothed and are therefore rightly referred by Laseron to *Pachydomus. Astartila polita* is referred to but not figured; and, if it is a typical specimen of that species, it is toothless and therefore belongs to the genus *Astartila.*

Descriptions of Species.

Astartila danai *De Koninck.*

(Plate xxv, figs. 8-11.)

Pachydomus danai De Kon., Mem. Geol. Surv. of N.S.W., Palæontology, No. 6. 1898, p. 218, pl. xix, fig. 5.

Observations.—In the above journal De Koninck described a species found in a greyish sandstone at Wollongong as *Pachydomus danai*, remarking, "Of all the species of *Pachydomus* known to me there is only *P. intrepida* (*Astartila intrepida*) Dana, of which the surface folds bear any resemblance to those of the shell in question. But this species is larger, more elongated, and relatively thinner."

A comparatively large series of specimens in the Varney Parkes collection agree both with the description and the figures of this species. They are edentulous, and, as no mention of teeth is made in De Koninck's description, I have referred his species to the genus *Astartila.*

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[7] De Koninck.—Mem. Geol. Survey of N.S.W., Pal No. 6, 1898, pp. 216-218.

[8] Stoliczka.—Cret. Fauna of Sth. India, Pal. Indica, Ser. vi, Vol. ii, p. 275.

[9] Laseron.—Journ. and Proc. Royal Soc. of N.S.W., Vol. xliv, pp. 212-215, and plates.

The following description has been derived from the series of specimens examined. Unfortunately in almost every instance the specimens are distorted, and the following description has been more or less compiled from the specimens as a whole.

Description.—The shell is medium sized and in general outline is more or less obliquely sub-oval, attaining a maximum length of about 30 mm. Equivalve but inequilateral. The two valves are in close apposition and are comparatively thin and compressed. The beaks are conspicuous, anteriorly placed and recurved anteriorly in a regular curve, which extends from the tip of the beak to the posterior extremity of the shell. The profile of the valve between the tip of the beak and the most anterior lateral portion of valve strongly concave. The interior cast possesses a flattened area anterior to the beak, and anterior again to this a distinct groove or sinus, which extends just short of the tip of the beak, to the anterior muscle scar. Posterior to the beak a groove extends obliquely downward, passing the posterior portion of the posterior muscular impression. These grooves would be represented by ridges on the interior of the external shell. The anterior muscular impression is almost reniform in shape, slightly excavate, and is marked with 4-5 vertical striæ. There is no trace of a smaller anterior muscular impression which served for the attachment of the pedal muscles. The posterior adductor muscle scars are large and broadly oval in outline. Two deep furrows, portion of the internal marking of the valve, traverse this scar. The pallial line is entire, well marked, and slightly curved. The hinge line is arched and the shell is edentulous. Ligament external and short.

The external sculpture of the valve consists of approximately fifteen growth folds or lamellæ separated from one another by distinct furrows. On well preserved specimens a series of numerous and fine striæ are superimposed on the growth plates or lamellæ. These are narrower in the centre of the shell and become broader near the beaks and the ventral margin. The growth folds are represented on the interior casts by furrows. The test is medium in thickness.

The dimensions of the figured specimens are approximately as follows:

	Plate xxv			
	fig. 9.	fig. 8.	fig. 11.	fig. 10.
Length	18 mm.	29 mm.	22 mm.	30 mm.
Height	15 mm.	24 mm.	22 mm.	25 mm.
Thickness ..	9 mm.	11 mm.	11 mm.	11 mm.

Localities and horizon.—Wollongong (De Koninck); Gerringong; Jerrawanglo; Schnapper Point, Kioloa. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA CYTHEREA *Dana.*

(Plate xxv, figs. 12-15, and pl. xxvi, fig. 1.)

Astartila cytherea Dana, Amer. Journ. Sci., (4), ii, 1847, p. 155. *Id.,* Dana, Wilkes' U.S. Explor. Exped., Geology, 1849, pp. 689-690, pl. iv, fig. 1, 1*a, b, c, d, e.* *Id.,* Dana, Eth. and Jenk., Geol. and Pal. of Q'ld. and New Guinea, 1892, p. 277, pl. xiv, figs. 3 and 4.

Dana's final description of this species is republished for reference.

"Thick, a little longer than high. Beak thrown a little forward. Exterior surface very coarsely concentric striate or costate; inner surface of valve smooth. Smaller anterior muscular impressions scarcely excavate, oblong sigmoid; larger strongly excavate and very abruptly so on the upper side, oblong sub-elliptical, crossed on the lower half posteriorly by a few (four or five) vertical lines, the transverse strong and neat. Posterior muscular impression a little excavate with neat transverse markings. Length $1\frac{3}{4}$ inches; height $\frac{89}{100}$ L; thickness $\frac{57}{100}$ L; apical angle about 100°.

Wollongong Point, district of Illawarra."

Observations.—This species is well represented in the Varney Parkes collection by a series of exceptionally well preserved specimens, which includes internal casts and complete testiferous shells. The entire series are smaller in size than the specimens figured and described by Dana, of which I possess plaster casts.

McCoy[10] published a description of a small shell which he called *Pachydomus ? pusillus.* He remarks that he had his doubts as to the correct genus for this form but finally decided upon the latter on account of the thick shell, external ligament, and general habit. Dana several years later, when publishing his final descriptions, placed this species in the synonymy of his *A. cytherea,* apparently treating it as a small form. In the large collection I have examined there is a series of specimens which consistently agree with McCoy's *Pachydomus pusillus.* This species has therefore been reinstated, but under the generic name of *Astartila,* not *Pachydomus,* as it is an edentulous form.

Included with the plaster casts of Dana's type specimens of this species was an internal cast which differed noticeably in form from the typical specimens. It undoubtedly should be referred to *A. cyprina,* and it is figured under this species.

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[10] McCoy.—Ann. Mag. Nat. Hist., xx, 1847, p. 302, pl. xvi, figs. 1, 2.

The characteristics of *A. cytherea,* as well as its relationships, were dealt with by Dana in his final paper, from which the following description is quoted:

"The proportions of this species; its beak thrown a little forward in the exterior shell as well as cast, so that in the latter the profile of the front below it is strongly concave; the anterior muscular impressions, and especially the abrupt depression (in cast abrupt elevation of half a line) at the upper side of each larger, are striking peculiarities of this species. The lateral surface of the beak in the cast is flattened, and this flattened area extends evenly to the large muscular impression. The anterior part is hardly more than one quarter the whole length, while it is one-third in the *cyprina.*"

The dimensions of the figured specimens, which include several casts of Dana's types, are approximately as follows:

	Pl. xxv, fig. 12.	Pl. xxv, fig. 15.	Pl. xxvi, fig. 1.	Pl xxv, fig. 13.
Length	38 mm.	30 mm.	46 mm.	33 mm.
Height	35 mm.	30 mm	45 mm.	34 mm.
Thickness ..	27 mm.	20 mm.	31 mm.	19 mm.

Localities and horizon.—Stonehumpy Ck., Bowen River (E. Edelfelt); Wollongong Point, district of Illawarra (Dana); Mt. Vincent (De Koninck); Jamberoo; Gerringong; Ulladulla; Branxton, Maitland district; Crooked River, Kiama. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA COMPRESSA *sp. nov.*

(Plate xxviii, figs. 6-11.)

Description.—This is a medium sized shell, which attains a length of approximately 40 mm. The valves are relatively shallow and in general outline are almost circular. The profile of the shell immediately below the beak is slightly concave. The umbones are blunt, not prominent, and almost centrally situated. They are slightly recurved anteriorly, and are in contact with one another. The hinge line is strongly arched. The test or shell is comparatively thin. The internal cast possesses a flattened area on the anterior lateral surface of the beak, and this extends from the tip to the anterior adductor muscle impression. A slight depression or groove, which would correspond to a ridge on the inner surface of the valve, extends downwards from the beak, posteriorly, to the pallial line. The posterior muscle scar is indistinct, subquadrate in shape, not excavate and is large. The anterior muscle scar is the smaller of the two, oval in shape and strongly excavate posteriorly. The pallial line is distinct, curved, and entire.

The ornamentation of the valves consists of growth plates or lamellæ. These are approximately ten in number, separated by distinct grooves, and superimposed are closely crowded concentric striæ. The internal surface of the valve is smooth.

The dimensions of the holotype and co-types are approximately as follows:

	Plate xxviii				
	fig. 11.	fig. 8.	fig. 9.	fig. 6.	fig. 10.
Length	42 mm.	38 mm.	40 mm.	30 mm.	41 mm.
Height	42 mm.	42 mm.	40 mm.	34 mm.	37 mm.
Thickness ..	16 mm.	16 mm.	15 mm.	—	17 mm.

Observations.—This species is apparently a very common species in the Upper Marine beds at Schnapper Point, Kioloa, in the South Coast district, and to my knowledge has not been collected elsewhere. The gritty sandstone in which they are preserved does not, however, favour perfect preservation, and the specimens are in most cases distorted, and characters are fragmentary. At first glance this species would appear to have more affinities with the genus *Pachydomus* than with *Astartila*, because of the heavy surface folds and comparative thickness of the shell substance. The absence of teeth in all specimens is the main character on which this species has been placed in the genus *Astartila*. It is a very characteristic type and differs markedly from all other members of the genus.

In the series examined there appears to be two definite types, but owing to the bad state of preservation of the specimens I have been unable to separate them. Further specimens may yet, however, come to hand, and the following points of difference may be of value:

(1) In Plate xxviii, figures 6 and 8, the shell is higher than long, figure 10 is longer than high, and in figures 7, 9 and 11 is as wide as long.

(2) The beak in the former is considerably recurved, and causes the profile of the valve below the beak to be concave. In the latter this is practically straight, and the beak, if recurved, is only slightly so.

(3) The test or shell substance in the former is thinner than in the latter.

Localities and horizon.—Jerrawanglo; Schnapper Point, Kioloa. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA CYPRINA *Dana*.

(Plate xxviii, figures 1-5.)

Astartila cyprina Dana, Amer. Journ. Sci. (4), ii, 1847, p. 155. *Id.*, Geol. Wilkes' U.S. Explor. Exped., 1849, p. 689; pl. iii, figs. 6 and 7.

Pachydomus cyprina De Koninck, Mem. Geol. Survey of N.S.W., Pal. No. 6, p. 217, pl. xviii, fig. 6.

Dana's description taken from his final paper is quoted for reference.

"Oblong, thick, length one-third greater than height. Exterior surface coarsely and unevenly concentric striate. Inner surface of valves minutely rugulose, and below the palleal impression vertically subplicate. Muscular impressions excavate; the smaller anterior oblong, sigmoid; the larger subquadrate, very convex, marked vertically with a few lines, the posterior hardly excavate. Length $2\frac{1}{12}$ inches; height $\frac{72}{100}$ L; apical angle 118°.

Wollongong Point, district of Illawarra."

Observations.—This species is represented by a small series of exceptionally well preserved specimens, which include both internal casts and testiferous valves. Two plaster casts of Dana's types of this species, one of an internal cast, and another showing portions of the external shell, have been used for comparative purposes. Also included with the above series is Dana's cast forwarded as *A. cytheria* but which possesses the characters of the present species. The majority of specimens I have examined are slightly smaller than those described by Dana, but in every other detail they agree perfectly with the typical species.

De Koninck has placed *cyprina* in the genus *Pachydomus*. After an examination of all specimens I can find no trace of teeth and therefore am compelled to refer this species back to *Astartila*, and to place *Pachydomus cyprina* De Kon. as a synonym.

The anterior adductor muscle scar is the larger of the two and is oblong with elongation in the direction of the striæ. The pallial impression has a slight curve, instead of the rather abrupt bend posteriorly which characterizes the members of the genus *Pachydomus*. These characters were pointed out by Dana, who also mentioned that the anterior muscular impression differs in form from that of *Pachydomus*.

Dana's remarks on this species are as follows:

"The vertical plications below the palleal impression are characteristic. It is also peculiar in the character of its larger anterior muscular impression and its proportional dimensions. Also, the

cast from the beak downward is but slightly flattened, and the space between the flattened area and the muscular impression is convex, owing to the continuation of the convexity of the muscular impression itself."

The dimensions of the figured specimens, chosen from the series examined, are approximately as follows:.

	Plate xxviii			
	fig. 5.	fig. 4.	fig. 1.	fig. 3.
Length	45 mm.	35 mm.	48 mm.	55 mm.
Height	30 mm.	38 mm.	40 mm.	45 mm.
Thickness ..	29 mm.	25 mm.	29 mm.	32 mm.

Localities and horizon.—Wollongong (McCoy); Flagstaff Hill, Wollongong (W. S. Dun). Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Astartila obliqua *sp. nov.*

(Plate xxv, figures 5-7.)

Description.—This is an extremely equilateral shell, equivalve, thick and oblong. It is considerably inflated and is at least one-third longer than high. Valves are strongly convex. The beaks are thick, wide apart, and are situated so far forward as to overhang the antero-lateral margin of the valve. The anterior lateral surface of the beak is flattened, and this flattened area extends almost to the pallial line. The posterior portion of the shell is convex and slopes away towards the margins. The junction between these two areas is in the form of a ridge, noticeable on the umbo and merging with the shell before reaching the pallial line.

The ornamentation of the external surface consists of broad concentric growth plates, which mark the various growth stages of the shell. These are about eight to ten in number and give the valve a coarsely costate appearance. Superimposed on these are finer and very numerous striæ, concentrically arranged. The inner surface of the valve is marked with minute radiating striæ, which terminate at the pallial line. These are more or less anastomosing in character. Below the pallial line ornamentation is absent except for a few indistinct folds. The muscle scars are unequal in size. The anterior adductor muscle scar is the smaller of the two, subquadrate in outline, and is excavate. The posterior scar is exceedingly large, and is elongated oval in shape. It is marked with very fine striæ. Pallial line is entire and slightly curved. A deep lunule is present just anterior to the beaks. The ligament is external, broad and elongated.

The dimensions of the figured specimens are approximately as follows. These include the holotype and co-types.

	Plate xxv		
	fig. 5.	fig. 7.	fig. 6.
Length	40 mm.	27 mm.	24 mm.
Height . ..	28 mm.	19 mm.	19 mm.
Thickness ..	28 mm.	19 mm.	16 mm.

Observations.—There is nothing, to my knowledge, in the *Astartilidæ* with which this species could be compared. The extreme anterior position in which the beaks are placed makes this an outstanding form, owing to its pronounced equilateral shape. Other strong characters are the median ridge and great length of the shell in comparison with its height.

Localities and horizon.—Cambewarra Mountains, near Jamberoo; Gerringong; Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA CORPULENTA *Dana.*

(Plate xxvi, figures 2-5.)

Astartila (?) *corpulenta*, Dana, Amer. Journ. Sci.. (4), ii, 1847, p. 155. *Id.*, Geol. Wilkes' U.S. Explor. Exped., 1849, p. 691, pl. 3, fig. 3.

Dana's final description of this species is as follows:

"Ventricose, oblong, a little inequilateral, sub-elliptical, prolonged in front, inferior margin arcuate; umbos elevated; surface concentrically subrugose. Length $1\frac{1}{2}$ inches; height $\frac{66}{100}$ L; thickness $\frac{54}{100}$ L; apical angle about 120°.

Wollongong Point, district of Illawarra."

Observations.—This species was placed only provisionally in the genus *Astartila* by Dana, owing to the lack of characters exhibited in his specimens. It is represented in the Varney Parkes collection by a comparatively large series of specimens. There seems to be little doubt that *Astartila* is its correct genus, for it is an edentulous form, which, together with such external characters as general outline, dimensions, and ornamentation, seems to point conclusively to that genus.

The sculpture on the external surface of the shell is coarsely costate or lamellated, giving the shell a roughened appearance. In many specimens which were examined the coarse sculpturing had been removed by erosion, leaving a smooth surface which shows faint traces of fine concentric striæ. The general outline and almost

equilateral form of this species are its most characteristic points. It may be separated from *A. cyclas*, which is also only slightly inequilateral and possesses the same type of sculpturing, by its length relative to height and its stoutness. *A. corpulenta* is much stouter than the former and is longer than high.

The dimensions of several of the better preserved specimens are approximately as follows:

	Plate xxvi		
	fig. 3.	fig. 2.	fig. 4. Dana's cast.
Length . ..	40 mm.	38 mm	37 mm.
Height .. .	23 mm	23 mm.	24 mm.
Thickness .	—	17 mm.	20 mm.

Localities and horizon.—Schnapper Point, Kioloa; Gerringong; Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA PARKESI *sp. nov.*

(Plate xxvii, figures 12-14.)

Description.—The shell is small, broad and thick, strongly inflated in the umbonal region. Equivalve and inequilateral; valve about one-third longer than high. The beaks are situated anteriorly, are fairly prominent and widely separated. They are slightly recurved posteriorly. The anterior slope of the valve strongly convex; posterior surface of valve is elongated and narrows considerably towards the extremity. The external sculpture consists of coarse concentric growth plates, approximately 10 in number. Superimposed on these are minor costæ, which are more numerous but indistinct. Musculature is uncertain. The posterior adductor muscle scars are the larger and are excavate, whereas the smaller scars are not excavate. On the internal cast a flattened area extends laterally from the tip of the beak to the pallial line. Pallial line curved and entire.

The dimensions of the holotype and co-types are approximately as follows:

	Plate xxvii		
	fig. 14.	fig. 12.	fig. 13.
Length	27 mm.	16 mm.	21 mm.
Height	20 mm.	10 mm.	15 mm.
Thickness ..	18 mm.	—	14 mm.

Observations.—This species resembles *A. corpulenta* to a certain degree, but differs in being a much smaller shell, and being considerably stouter, when the different proportions of the two shells are taken into consideration. The beaks on *A. corpulenta* are almost median in position and divide the shell into practically even posterior and anterior portions. In this species the beaks are

anterior in position, and the anterior portion of the shell is only one-third the length of the valve. The lateral portion of the beak has a flattened surface in the latter, whereas in the former it is absent.

Localities and horizon.—Gerringong; Wyro, near Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Astartila cyclas *Dana.*

(Plate xxv, figures 1-4.)

Astartila cyclas, Dana, Amer. Journ. Sci. (4), ii, 1847, p. 155. *Id.*, 1849, Geol. Wilkes' U.S. Explor. Exped., p. 690, pl. 4, fig. 3.

Dana's final description of this species, published in 1849, is as follows:

"Rather thin, a little longer than high, nearly equilateral, apical angle large. Exterior surface marked unevenly with irregular con centric striæ. Anterior muscular impression strongly excavate; larger sub-orbicular, without vertical striæ; smaller narrow, oblong. Posterior muscular impression hardly excavate. Length 1¼ inches; height $\frac{90}{100}$ L.; thickness of cast $\frac{40}{100}$ L.; apical angle of shell 135°.

Wollongong Point, district of Illawarra."

Observations.—This species is represented by a series of casts and complete testiferous shells with the external marking well preserved. The internal cast of this species is one that is very characteristic owing to its extreme thinness, particularly on the antero-lateral and ventral margins. It has a distinct keeled appearance being swollen in the umbonal region and flattening out towards the margins. The lateral surface of the beak is flattened and extends from the tip of the beak to the pallial line. The anterior muscular scar is strongly excavate, vertical in position and faces obliquely inwards. Smaller anterior muscle scar is absent in specimens examined. The area between the flattened surface and the muscle scar is slightly concave or flat. The external sculpture or marking of the valve consists of broad, irregular, coarse, concentric growth plates. These are about 6-8 in number and are separated from one another by grooves or depressions. Finer striæ are also present superimposed on the growth plates. The internal surface of the valve is lightly marked with transverse rugosities above the pallial line. Several indistinct folds may be present beyond the pallial line. External ligament is rather well developed, external, and elongated.

Dana remarks:

"This is the thinnest of the species obtained. The beak of the cast is very thin, and the flattened area distinct; the surface between this area and the muscular impression is flattened or slightly concave. The cast has the margin thin as in *cyprina*. The smaller anterior muscular impression is vertical and faces very obliquely inward. The pallial impression is very distinct. The anterior portion of the shell is more than a third of the whole length."

The dimensions of several of the figured specimens are approximately as follows:

	Plate i		
	fig. 1. (Dana's cast)	fig. 3.	fig. 4.
Length	34 mm.	38 mm.	34 mm.
Height	26 mm.	30 mm.	25 mm.
Thickness ..	15 mm.	9 mm (one valve)	17 mm.

The internal cast, possessing as it does the very flattened margins, bears a resemblance to *A. cyprina*, but differs in being much smaller and also in the fact that the beaks are not produced anteriorly as in the latter species. The complete specimen with the test preserved is almost equilateral in form and therefore an outstanding form and one that could hardly be mistaken for any other species in the genus *Astartila*.

Localities and horizon.—Gerringong; Schnapper Point, Kioloa; Cabbage-Tree, Jervis Bay; Conjola. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA POLITA *Dana.*

(Plate xxvi, figures 9-12.)

Astartila polita Dana, Amer. Journ. Sci., (4), ii, 1847, p. 155. *Id.*, Geol. Wilkes' U.S. Explor. Exped., 1849, p. 690, pl. iv, fig. 2.

Pachydomus politus, De Kon, Mem. Geol. Survey of N.S.W., Pal., No. 6, 1898, p. 218, pl. xix, fig. 4.

Dana's description of this species is reproduced for reference:

"Rather thin, somewhat longer than high. Exterior surface smooth and shining, with faint concentric lines. Valves thin. Muscular impressions very slightly excavate, palleal faint. Large anterior muscular impression with transverse striæ, but none vertical. Length 1 to $1\frac{3}{4}$ inches; height $\frac{24}{100}$ L.; thickness $\frac{50}{100}$ L.; apical angle 114°.

Black Head, district of Illawarra."

Observations.—This is an edentulous form and therefore must be referred to the genus *Astartila* and not to *Pachydomus* where De Koninck placed it. Dana in his observations remarks that "The shining exterior and thinness of the shell are peculiar and its texture in the specimens seen was usually rather soft and dark green in colour, like a compact chlorite. The lateral surface of the beak in the cast is flattened, nearly as in *cytheria*."

Several of the above distinctions, such as the shining exterior, texture and colour appear to me to be rather vague characters, and would depend a great deal on the beds in which the specimens were preserved. Many of the specimens examined have these characteristics, but I would hesitate in saying that they were peculiar to the species. I have assumed that Dana in giving the dimensions of his specimens bases the height and thickness on the percentage of the length of the shell. For instance, a height of $\frac{50}{100}$ L. would be half as high as long. In his preliminary paper Dana gives the height of this species as $\frac{24}{100}$ L., but this is undoubtedly an error and should read $\frac{74}{100}$ L., which is the height given in his final paper in 1849.

In the series of specimens I have examined, there appears to be only very slight differences between *A. polita* and *A. transversa*. Dana in his description states that the valves as well as the shell are thin in the former and thick in the latter, but I fail to see marked difference in thickness, even when comparing the plaster casts of his types. The dimensions given in both of Dana's descriptions are also practically identical. Furthermore both these species possess the flattened lateral surface of the beak and it is equally prominent in *A. transversa* and in *A. polita*.

The main differences between these two species may be briefly summed up as follows:

(1) The beaks in the cast of *A. polita* are more upright than in *A. transversa,* giving the latter species a more compressed and elongated appearance.

(2) The distance between the tip of the beak and the anterior muscle scar is greater in *A. polita* than in *transversa,* and furthermore in the former the profile is concave, while in the latter it is more or less straight.

(3) The anterior adductor muscle scar in *A. polita* has its long axis much more nearly horizontal in position than in *A. transversa*; the scar in the latter is practically vertical in position and is also more distinctly marked with vertical striæ.

These characters, although seemingly definite, appear to vary in the series I have examined, and it is only after a very close

examination and comparison that these two species may be separated, unless extreme types are met with. There is a gradation between the two species and the characters vary considerably.

The dimensions of several specimens chosen from the Varney Parkes collection, and figured are approximately as follows:

	Plate xxvi			
	fig. 11.	fig. 12.	fig. 10.	fig. 9.
Length	35 mm.	30 mm.	32 mm.	40 mm.
Height	26 mm.	25 mm.	25 mm.	30 mm.
Thickness ..	18 mm.	15 mm.	20 mm.	21 mm.

Localities and horizon.—Wollongong (W. B. Clarke); Black Head, Illawarra (Dana); Gerringong; Jamberoo; Crooked River, near Kiama; Wyro, near Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA TRANSVERSA *Dana.*

(Plate xxvi, figures 13-17.)

Astartila transversa, Dana, Amer. Journ. Sci., (4), ii, 1847, p. 155. *Id.*, Geol. Wilkes' U.S. Explor. Exped., 1849, p. 690, pl. 4, fig. 4.

Dana's final description of this species is as follows:

"Thick, oblong (length one third greater than high). Posterior muscular impression faint; larger anterior sub-elliptical, somewhat excavate, without vertical striæ; smaller obliquely excavate, sigmoid. Length of cast 1½ inches; height $\frac{78}{100}$ L.; thickness $\frac{55}{100}$ L. Apical angle of cast 105°, of shell 115°.

Wollongong Point, district of Illawarra."

Observations.—In my remarks on *A. polita* I pointed out that there is a very close similarity between that species and *A. transversa*, and enumerated the differences. Dana in his remarks on this species says: "This species is remarkable for being a third longer than high. It has the lateral surface of the cast, from the beak downward, strongly flattened, and between this area and the muscular impression, the surface (which is of the same width as the flattened area) is also flattened or a little concave. The palleal impression is faint."

The dimensions of *A. polita* and *A. transversa* are practically the same, and the flattened surface of the beak is also present on both species to the same degree. In this species the external marking of the shell is not as coarsely costate as in other species of *Astartila*. On the growth plates are superimposed numerous fine concentric costæ, which are very distinct after slight erosion has taken place. The internal surface of the valve is covered with

minute irregular rugosities and some indistinct folds below the pallial impression.

The dimensions of the figured specimens are approximately as follows:

	Plate xxvi			
	fig. 16.	fig. 13.	fig. 15.	fig. 14. Dana's cast.
Length	35 mm.	40 mm.	34 mm.	37 mm.
Height	25 mm.	30 mm.	25 mm.	28 mm.
Thickness ..	19 mm.	20 mm.	18 mm.	23 mm.

Localities and horizon.—Gerringong; Wyro, near Ulladulla; Wollongong Point, district of Illawarra (Dana). Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA INTREPIDA *Dana.*

(Plate xxvi, figures 6-8.)

Astartila intrepida, Dana, Amer. Journ. Sci., (4), ii, 1847, p. 155. *Id.,* Geol. Wilkes' U.S. Explor. Exped., 1849, p. 689, pl. iii, fig. 5.

Pachydomus ovalis (?) McCoy, Ann. Mag. Nat. Hist., xx, 1847, p. 302, pl. xiv, fig. 4.

The final description of this species published by Dana in 1849 is as follows:

"Thick, length but little greater than height, anterior part about one-third whole length. Lateral surface evenly convex, marked quite neatly with concentric striæ. Anterior muscular impressions excavate; the smaller sub-quadrate, the larger transverse with a number of fine vertical lines on the posterior quarter. Length $1\frac{3}{4}$ inches; height $\frac{80}{100}$ L.; thickness $\frac{52}{100}$ L.; apical angle about 120°.

District of Illawarra, at Wollongong Point."

Observations.—Several specimens from the Varney Parkes collection have been referred to this species. They agree exactly with Dana's description, which is as follows:

"This is a thick species distinguished by its anterior muscular impressions and general proportions. The cast from the beak obliquely downward is strongly flattened; and between this area and the large anterior muscular impression, the surface is somewhat convex, and moreover it is smooth without minute corrugations. The striæ of the exterior surface are strong and quite neat, although somewhat irregular, and the surface is a little shining."

The dimensions of several specimens, including a cast of Dana's type of this species, are approximately as follows:

	Plate xxvi fig. 8.	fig. 7.	fig. 6. (Dana's cast)
Length	41 mm.	42 mm.	43 mm.
Height	31 mm.	33 mm.	35 mm.
Thickness	23 mm.	21 mm.	23 mm.

Localities and horizon.—Wyro, near Ulladulla; Wollongong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA OVATA *sp. nov.*

(Plate xxvii, figures 1-5.)

Description.—The shell is of small size, oblong and longer than high. Its beaks are prominent, placed fairly wide apart and are anteriorly situated. Distance between the tip of the beak and the anterior muscle scar is short, and the profile is concave. The valve is strongly convex and flattens out only at the margins. The anterior portion of the shell is at least one-third the length of the valve. The anterior muscle scar is small and obliquely excavate. In outline it is subquadrate and marked with transverse striæ. The posterior muscle scar is the larger of the two. It is broadly oval in shape, slightly excavate, and ornamented with concentric growth rings. The smaller anterior muscle scar is absent. The pallial line is entire, slightly curved and distinct. The lateral surface of the umbo is flattened, and this flattened surface extends downward to the pallial line. The area between the anterior muscle scars and the flattened surface is concave. The interior surface of the valve is smooth except for a few indistinct folds. External ornamentation unknown. The ligament is external, short, and narrow.

The dimensions of the holotype and co-types which have been figured are as follows:

	Plate xxvii fig. 1.	fig. 2.	fig. 3.
Length	18 mm.	20 mm.	20 mm.
Height	15 mm.	18 mm.	16 mm.
Thickness	—	10 mm.	—

Observations.—This species, to my knowledge, has been collected only in the Wandrawandian Series and is always enclosed in a fine matrix of ferruginous sandstone which is literally crowded with pelecypod and brachiopod remains. It is a very handsome shell somewhat similar to *A. polita* but differing markedly in the small size and in the fact that the anterior muscle scars are strongly excavate and small in comparison with the size of the shell. The flattened surface of the umbo is also very wide. In the series of

specimens examined there appears to be two definite types, one which possesses the flattened umbo, and another in which it is absent or nearly so. The latter type has a narrow ridge extending from the posterior side of the beak to the back of the posterior muscle scar. This, in the internal cast, is present in the form of a slight groove. It is also more elongated than the typical species, but, owing to lack of material, the separating of these two forms must wait. I have no doubt that further material will prove this another species or at least a variety.

Localities and horizon.—Wandrawandian Series, Tianjarra, south coast of New South Wales. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA QUADRATA *sp. nov.*

(Plate xxvii, figures 6-8.)

Description.—This is a medium sized, oval shell very thick and almost equilateral. Valves strongly convex. The beaks are almost median in position, very blunt in the complete shell and slightly produced in the cast. Anterior and posterior lateral margins of the valve, between the beaks and the anterior muscle scars, straight. Anterior adductor muscle scars are obliquely excavate, broadly oval in outline and ornamented with fine transverse striæ. No trace of smaller anterior scar. Posterior adductor scar large and not excavate. Ligament external, broad, and narrow.

The external sculpturing of the valve consists of concentric growth plates separated by comparatively deep grooves or depressions. Superimposed on the growth plates are numerous fine striæ. The internal surface of the valve is quite smooth. The growth plates give the exterior of the valve a roughened appearance.

The dimensions of the figured specimens, which include the holotype and co-types, are approximately as follows:

	Plate xxvii		
	fig. 6.	fig. 7.	fig. 8.
Length	30 mm.	31 mm.	30 mm.
Height	27 mm.	27 mm.	24 mm.
Thickness	20 mm.	20 mm.	17 mm.

Observations.—There is no other member of the genus *Astartila* which possesses the same stoutness in comparison with length. It is an outstanding form in virtue of its almost equilateral form, its dimensions, and strong ligament.

Localities and horizon.—Wollongong; Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Astartila delicatula *sp. nov.*

(Plate xxvii, figures 9-11.)

Description.—This is a small shell which attains a length of approximately 20 mm. only. It is inequilateral and equivalve, produced posteriorly, and slightly longer than high. The beaks are prominent, anteriorly situated and pointing anteriorly. The valves are convex anteriorly and flattened posteriorly. This flattened surface extends downward, parallel to the umbo, to the ventral margin. The line of demarcation between these two areas produces a ridge which gives the shell a very characteristic appearance. The larger anterior adductor muscle scar has its long axis vertical in position and in shape it is narrow and elongated. It is obliquely excavate. No trace of smaller anterior muscle scars. The posterior adductor scar is large and only faintly discernible.

The external valve ornamentation consists of about eight concentric growth plates. These are smooth and separated by shallow grooves. The whole surface is then traversed by numerous fine concentric striæ which is very characteristic and gives the shell a very delicate appearance. The internal surface of the valve is marked with four or five ridges, which appear in the internal casts as grooves.

The dimensions of the figured specimens are approximately as follows:

	Plate xxvii		
	fig. 9.	fig. 10.	fig. 11.
Length	21 mm.	16 mm.	19 mm.
Height	18 mm.	14 mm.	16 mm.
Thickness	6 mm.	6 mm.	8 mm.

Observations.—This species is represented by a small but excellently preserved series of specimens, which include examples of testiferous united valves and internal casts. In form they resemble *A. subcarinata* and also in the ornamentation, as both species possess the very accentuated fine external sculpturing. The differences may be briefly summed up as follows:

(1) *A. subcarinata* is a large shell compared with the present species, which is only one-third to one-quarter the size of the former.

(2) *A. subcarinata* has a flattened portion on the beak of the internal cast extending from the tip of the beak to the pallial line. This is absent in *delicatula*.

(3) The shell of *A. subcarinata* is produced more posteriorly than in the present species.

Localities and horizon.—Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA PUSILLA (*McCoy*).

(Plate xxix, figures 8-12.)

Pachydomus pusillus McCoy, Ann. Mag. Nat. Hist., xx, 1847, p. 302, pl. xvi, figs. 1 and 2. *Id.,* De Kon., Mem. Geol. Survey of N.S.W., No. 6, 1898, p. 217, pl. xix, fig. 2.

Observations.—This species was originally described by McCoy in 1847 under the name of *Pachydomus pusillus.* In 1849 Dana placed it as a synonym of his *Astartila cytherea*, but De Koninck in 1898 restored it to its original genus, *Pachydomus.* This species is represented by a comparatively large series of specimens including both testiferous united valves and internal casts. They are all edentulous forms, and in McCoy's types, of which I have plaster casts, there is also no trace of teeth. As the genus *Pachydomus* is characterised by the possession of teeth, it is necessary again to place McCoy's species in the genus *Astartila.*

The following description has been compiled from the series examined, which as a rule are smaller in size than McCoy's type specimens.

The shell is small and globose; it is as high as long or higher, and slightly higher than thick. Valves are strongly convex, with a rounded ventral margin. The beaks are pointed, median in position, produced above the hinge line and recurved anteriorly. They are placed fairly wide apart. The lateral surface of the beak is flattened, and the flattened area extends from the tip of the beak to the adductor muscle scar. The larger anterior muscle impression is obliquely excavate, subquadrate in shape, and is placed parallel to the direction of the beaks. The posterior muscle scar is broadly oval and superficial. It is the larger of the two. Pallial impression is entire and gradually curved. The external valve ornamentation consists of rather coarse growth plates, with finer striæ superimposed. Internal surface of valve smooth. Hinge line arched; test of shell thin.

The dimensions of the figured specimens are approximately as follows:

	Plate xxix			
	fig. 10.	fig. 11.	fig. 12.	fig. 9.
Length	19 mm.	16 mm.	20 mm.	17 mm.
Height	22 mm.	18 mm.	21 mm.	19 mm.
Thickness ..	18 mm.	13 mm.	18 mm.	14 mm.

This species may be separated from *A. cytheria,* the only other group of *Astartila* which it resembles in any way, by its small size and great thickness. Its sharp pointed beaks projecting well above the hinge line make it an outstanding type.

Localities and horizon.—Wollongong sandstone (McCoy); Jamberoo; Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

Astartila centralis *sp. nov.*

(Plate xxix, figures 4-7.)

Description.—This is a medium sized shell, fairly globose, and attains a length of approximately 22 mm. The valves are strongly convex in the umbonal region but flatten out towards the margins. The beaks are prominent, anteriorly situated, and point anteriorly. In the cast widely separated. The anterior lateral surface of the umbones is flattened, and this flattened surface, which is of considerable extent, extends from the tip of the beak to the pallial line. The surface between the adductor muscle scars and the flattened area is concave. The larger anterior scars are subquadrangular in shape and are marked with vertical striæ. The upper portion of the scar excavate. The posterior scar is subcircular in outline, slightly excavate, and marked with three or four heavy curved striæ. Pallial line is distinct, entire and slightly curved. The external valve marking consists of fairly coarse concentric growth plates, separated by slight grooves. Test is very thin, the ligament external, short, and broad.

The dimensions of the figured specimens, which include the holotype and co types, are approximately as follows:

	Plate xxix			
	fig. 7.	fig. 6	fig. 5	fig. 4.
Length	21 mm.	21 mm.	22 mm.	24 mm
Height	20 mm.	20 mm.	21 mm.	23 mm
Thickness ..	15 mm.	15 mm.	13 mm.	14 mm

Observations.—This is a fairly common species and, so far as I know, has been collected only from the Gerringong beds. They have been excellently preserved, and include testiferous united valves and internal casts. It has a slight resemblance to *A. cytheria* but differs from that species in not having the beaks produced above the hinge line, and also in being smaller in size. The muscle scars in this species are strongly excavate, whereas in *A. cytheria* they are not so pronounced.

Locality and horizon.—Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA SUBCARINATA *sp. nov.*

(Plate xxix, figures 1-3.)

Description.—This is a thick and inflated shell, longer than high, and equilateral. The beaks are anteriorly situated and point anteriorly. A narrow groove extends from the anterior portion of the beak downwards past the anterior muscle scar, to the pallial line. This on the internal surface of the valve would be in the form of a ridge. The posterior portion of the shell is flattened, and the flattened portion extends from the tip of the beak to the ventral margin. The line of demarcation between the convex anterior portion and the flattened posterior portion of the shell is very pronounced. The large anterior muscle impression is only slightly excavate. It is sub-quadrangular in outline and the long axis is almost vertical in position. There is no trace of a smaller anterior muscle scar. The posterior muscular impression is not excavate, and is the larger of the two. It is broadly oval in shape. The external marking of the shell consists of growth plates which are comparatively smooth and numerous. Finer striæ are superimposed on these growth plates concentrically.

The dimensions of the figured specimens which include the holotype are approximately as follows:

	Plate xxix		
	fig. 1.	fig. 2.	fig. 3.
Length	40 mm.	31 mm.	33 mm
Height	33 mm.	28 mm.	30 mm
Thickness	34 mm.	20 mm.	19 mm

Observations.—This species is an outstanding type of the members of the *Astartila* group and can be compared with only one species, *A. delicatula*. Both species bear a slight resemblance to members of the genus *Mœonia*, on account of the ridge which separates the flattened and the convex regions of the shell. The characters, however, entirely disassociate them from that genus. The main points of difference between the two species is that *A. delicatula* is a much smaller form than the present species, and is also not so inflated. It may be possible that *A. delicatula* is a small form of this species, but until further specimens come to hand showing a gradation between the two species they must be kept separate.

Localities and horizon.—Wyro, near Ulladulla; north of North Head, Ulladulla. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

ASTARTILA SUBGEMMA *sp. nov.*

(Plate xxix, figures 13-15.)

Description.—This is a small shell, somewhat oval in outline and inflated. The valve flattens out towards the margins,

particularly anteriorly. The beaks are practically median in position, giving the shell an equilateral appearance, and are blunt. The anterior muscular impression is large, broadly oval in outline and is obliquely excavate. The posterior muscle impressions are oval, slightly excavate and ornamented with curved striæ. Pallial line is entire and slightly curved.

The dimensions of the figured specimens are approximately as follows:

	Plate xxix		
	fig. 13.	fig. 14.	fig. 15.
Length	18 mm.	14 mm.	16 mm.
Height	15 mm.	12 mm.	14 (?)
Thickness	10 mm.	8 mm.	—

Observations.—This small and dainty shell is one that could be readily mistaken for *Astarte gemma.* In the series of specimens examined there were found specimens which were edentulous while others possessed teeth. Externally the characters were identical, so that this species is, one might say, an *Astarte gemma* which is toothless.

Localities and horizon.—Gerringong. Permo-Carboniferous, Upper Marine Series.

Collection.—The Australian Museum, Sydney.

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I herewith wish to express my indebtedness to Mr. W. S. Dun for his friendly criticism and discussion on many of the points raised during the compilation of this paper. To Mr. G. C. Clutton my thanks are due for the excellent photographs from which the plates were reproduced.

HERPETOLOGICAL NOTES.

No. I.

BY

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These notes concern specimens in the Australian Museum reference collection.

HYLOPHORBUS ROBUSTUS *Boulenger.*

Mantophryne robusta Boulenger, Proc. Zool. Soc. Lond., 1898, p. 476 and p. 480, pl. xxxviii, fig. 4.

Gnathophyrne robusta v. Mehely, Termesz. Füzetek, xxiv, 1901, p. 225, pl. vi, figs. 1-3 (skull), pl. ix, figs. 6-9 (eggs and embryo).

Hylophorbus robustus Van Kampen, Amphibia Indo-Australian Archipelago, Leiden, 1923, pp. 143-144.

Hylophorbus sp. Kinghorn, Rec. Austr. Mus., xvi, 6, 1928, p. 289.

When I made my first note on this species only three specimens were available, but I have since received three more from the collection of the late Professor Launcelot Harrison; all were collected in the Mount Lamington district, Northern Division, Papua, by Mr. C. T. MacNamara. While the specimens agree in all major characters with *H. robustus*, some of them have minor characters in common with *H. microtis* and these are worth noting.

The interorbital space may be from once and one-third to once and four-fifths as broad as the upper eyelid, and the tympanum is almost as large as the eye.

The skin of five specimens preserved in Bles solution is quite smooth, and the general colour is greenish black above and grey below, the central area of the back being much faded, almost to pinkish grey. On the lateral and dorsal areas are a number of black spots each with a yellowish-white centre, forming a kind of ring, each spot being on a slightly raised area. The whitish patch in the groin may be small and almost circular in shape, or large

and irregular. The undersurface is finely speckled with white dots. The spirit specimen has a somewhat rugose skin; the colour is brown above and yellowish white below. There is a large whitish patch in the groin, and the sides are white spotted, but the dark brown spots of the dorsal surface, which are raised up, have not the white centres common to the specimens preserved in the Bles solution.

CERAMODACTYLUS DAMAEUS *Lucas and Frost.*

Ceramodactylus damaeus L. and F., Proc. Roy. Soc. Victoria (n.s.), viii, 1896, p. 1, and Rept. Horn. Sci. Exped., pt. ii (Zoology), 1896, p. 119, pl. ix, fig. 2. *Id.,* Boulenger, Ann. Mag. Nat. Hist., (6), xviii, p. 233.

When Boulenger described his new species *Diplodactylus stenodactylus* in the work quoted, he made the following note which attracted my attention and led to this examination: "This new species, described from a single male specimen without tail, is allied to and appears to connect *Diplodactylus steindachneri,* Blgr., and *Ceramodactylus damaeus,* Lucas and Frost, the latter probably bearing no real affinity to the genus to which it has been referred."

I have examined the paratypes, from Charlotte Waters, Central Australia, together with several other specimens, and find that the species is not referable either to *Ceramodactylus* Blanf., or *Diplodactylus* Gray. In the general shape of the body, limbs and the swollen palmar surfaces it resembles *Rhynchoedura*, but it is so constantly different from any of these in other characters that I feel it should be placed in a new genus, and I would suggest the name *Lucasius* after one of its founders, Mr. A. H. S. Lucas.

As in the genus *Rhynchoedura*, the digits are granular inferiorly, but each granule is spine-like. The mental and rostral are normal, not nail-shaped, and the labials are distinct, while in *Rhynchoedura* they are absent.

LUCASIUS, *gen. nov.*

Generic definition.—Digits cylindrical, covered above with imbricate scales and on the sides and undersurfaces with small spine-like tubercles. The claw is retractile beneath a nail-like scale, and surrounded below and at the sides by a rosette of small spine-like tubercles. Body covered with imbricate scales; tail with squarish imbricate scales.

Genotype.—*Ceramodactylus damaeus* Lucas and Frost.

The measurements of the specimens examined are given below:

	Total Length.	Body.	Tail.	Snout to Ear.	Width of Head.	Length of Limbs.	
						Fore.	Hind.
A	—	45	—	12	8·5	15	20
B	69	34	35	9	6·5	15	18
C	81	49	43	7	9	15	21
D	95	42	53	12	10	18	22·5
E	91	48	43	12	10	17	22
F	90	47	43	11·5	9·5	16·5	21
G	85	45	40	11·5	9	16	19·5
H	74	38	36	10·5	9	14	17·5
I	90	44	46	11·5	9	16	20

The specimens before me are from the following localities: Five from Charlotte Waters, Central Australia (these include the paratypes); two from the vicinity of Perth, Western Australia; one from Ooldea, South Australia; one from Pooncarie, on the Darling River, New South Wales. The last reached me while I was writing and constitutes a new record in the distribution of the species. This specimen is beautifully marked, the typical white spots being on brick-red markings.

Diplodactylus vittatus *Gray*.

Diplodactylus vittatus Gray, Brit. Mus. Cat. Liz., 1845, p. 148. *Id.*, Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 100.

Diplodactylus polyophthalmus Günther, Ann. Mag. Nat. Hist., (3), xx, 1867, p. 49. *Id.*, Boulenger, *loc. cit.*, p. 101.

I have examined a series of seventy specimens of this species ranging from 43 mm. to 95 mm. in length, and cannot find any variations which prove sufficiently constant to warrant the separation of *D. polyophthalmus* from *D. vittatus*.

Some specimens which have the typical colour markings of *D. vittatus* have the snout longer than the distance from the eye to the ear, while in others the snout may be equal to, or even slightly shorter than that distance. The tubercles under the digits are also very variable as to size and shape, and I cannot attach any importance to them as specific characters.

Before me are five specimens from the same locality near Sydney; two have the typical markings of *D. vittatus*, the third has the vertebral stripe more or less broken up, in the fourth there are distinct round paired spots on the dorsal line and smaller spots on the side, while the fifth is greyish with indistinct light spots. In all of these specimens the tubercles under the digits are large oval in shape, the snout is longer than the distance from the eye to

the ear, and the digits vary a little in length and stoutness. There are occasional specimens throughout the series which vary so much within the limits of the so-called two species that I cannot place them either as the *polyophthalmus* or *vittatus* variety.

DIPLODACTYLUS TÆNICAUDA *De Vis.*

Diplodactylus tænicauda De Vis, Proc. Linn. Soc. N.S.W., (2), i, 1886, p. 169.

Diplodactylus tæniocauda Boulenger, Brit. Mus. Cat. Liz., iii, 1886, p. 483.

There are six specimens of this interesting species in the Australian Museum collection, of which three are from Cardwell, one from Dawson River, and two from Eidsvold, Burnett River; all these localities are in Queensland.

Examination shows that the external characters do not vary to any extent within the series, nor do they differ much from already published descriptions. As regards colour, the species is very distinctly marked, and the specimens before me exemplify this to a marked degree. The whole of the body, arms and legs are finely spotted with dark brown on a yellowish ground. The typical reddish brown band, which commences at the base and extends to the tip of the tail, is, in my specimens, bordered by darker bands, chocolate brown in colour and spotted with irregular white markings.

DIPLODACTYLUS PULCHER *Steindachner.*

Diplodactylus pulcher, Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 102.

The collection has lately been enriched by six specimens of this beautiful and comparatively rare species from Western Australia. While the structural characters and scaling agree with Boulenger's description, the colour of my specimens is very variable. In four specimens from Perth, and one from Malcolm, the general colour is reddish brown above and there is a dark line across the occiput, besides the usual irregular, transverse, light, dark-edged spots on the back. In the remaining specimen from Boulder, which is only half-grown, the colours are particularly bright. The band on the neck and that behind the shoulders are narrower than usual, and two on the centre of the dorsal area are divided into roundish spots, below which are several large white spots, and a row of smaller ones along the lateral line.

DIPLODACTYLUS SPINIGERUS *Gray.*

Strophura spinigera Gray, Brit. Mus. Cat. Liz., 1845, p. 148.

Diplodactylus spinigerus Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 99.

Diplodactylus ciliaris Boulenger, *loc. cit.*, p. 98, pl. vii, fig. 2.

Diplodactylus intermedius Ogilby, Rec. Austr. Mus., ii, 1892, p. 10.

Diplodactylus spinigerus Zietz, Rec. South Austr. Mus., i, 3, 1920, p. 185.

When Zietz published his catalogue of the Australian lizards, he included a number of species in the synonymy of *D. spinigerus,* but, while I agree that *D. ciliaris* and *D. intermedius* are synonymous with *D. spinigerus,* I am convinced that *D. strophurus* is a separate species.

I have examined a very large series of specimens and find that, while the dorsal tubercles of *D. spinigerus* and *D. ciliaris* are almost identical, the spines on the tail of the former are much shorter and there are no spines on the supraciliary border, the latter being a feature of *D. ciliaris* only. The dorsal tubercles may be in two distinct rows, which may be regular or irregular through the presence of scattered ones breaking the lines at intervals. These tubercles are never so scattered or irregular as in *D. strophurus*.

The spines of the supraciliary border and the tail appear to be much more highly developed in the more northern forms, and would suggest the possibility of a geographical variety or race. It might be convenient to regard the specimens from the far north and north west Australia as varieties, but I do not think there are sufficient grounds to warrant them being placed in a separate species.

The specimens examined are from the following localities, and for convenience I am recording them under their original names:

D. spinigerus.—New South Wales: Tamworth (8), Lachlan River (3), Yandembah (2), Barmedman (1), Coonamble (2), Wyalong (3), Hillston (1). Western Australia: Esperance (1), Perth (1). Queensland: Bowen (1).

D. intermedius.—New South Wales: The interior (3 types), Boggabri (3), Lachlan River (2), Carinda (1). Locality unknown: (8).

D. ciliaris.—Queensland: Sylvania (2). North Australia: Darwin (3), King Sound (1). Western Australia: Malcolm (1).

DIPLODACTYLUS STROPHURUS *Dumeril and Bibron.*

Diplodactylus strophurus Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 100.

Diplodactylus spinigerus part Zietz, Rec. South Austr., Mus. i, 3, 1920, p. 185.

As stated in my remarks concerning the previous species, I do not agree with Zietz in placing this species in the synonymy of *D. spinigerus.* It is evidently a very rare species, and, despite the fact that it is recorded from Sydney (in the British Museum Catalogue), I think some mistake was made, for it appears to be restricted to localities in the vicinity of the Murrumbidgee River, and particularly south-western New South Wales.

There are three specimens only in the Australian Museum collection, two being from Hillston, and one from Leeton, in the Murrumbidgee Irrigation Area; the latter was collected by me in November, 1927.

The head of *D. strophurus* is shorter and deeper than that of *D. spinigerus*, there are small and large tubercles scattered over the dorsal area, but nothing to resemble spines. The tail of the Leeton specimen is long and thin, without tubercles; in the two from Hillston, in which the tail is rejuvenated, the new part is very short and thin, suggesting to me that the originals were like those of the Leeton specimen.

NOTES ON THREE ALLIED SPECIES OF *Diplodactylus.*

In the following notes I wish to discuss the characters and affinity of the following species:

Diplodactylus hilli Longman, Mem. Qld. Mus., iii, 1915, p. 32, *Diplodactylus conspicillatus* Lucas and Frost, Proc. Roy. Soc. Vict., new ser., ix, 1897, p. 55, and *Diplodactylus platyurus* Parker, Ann. Mag. Nat. Hist., (9), xvii, 1926, p. 665.

Through the kindness of Mr. H. A. Longman, Director of the Queensland Museum, I have been able to examine the holotype of his species and compare it with Parker's description of *D. platyurus* and several previously unnamed specimens in the Australian Museum collection. The three species are undoubtedly closely allied and strikingly alike in general appearance. It was the following statement by Parker which led me to make the examination:

"This species appears to be closely allied to *D. hilli,* Longman, and *D. conspicillatus,* Lucas and Frost; from the former it may be distinguished by its longer snout and broader rostral, from the latter by its broader rostral, large upper caudal scales, and the coloration."

As an examination of the specimens shows that the upper caudal scales of both *D. hilli* and *D. conspicillatus* are quite four times as large as the dorsal body scales, and evidently like those of *D. platyurus,* this character is common to all, and of no specific value. There may not be as much difference between *D. hilli* and *D. platyurus* as the respective descriptions would imply. In measuring the length of the snout Longman has evidently taken the distance from the anterior border of the eye to the end of the rostral, and has compared that with the distance from the same starting point to the ear, and not from the posterior border of the eye to the ear as one might assume. The absence or presence of the median cleft in the rostral is not a constant character, as one of my specimens shows a short cleft in the rostral while another has none. The following table of measurements should help in sorting out some of the most outstanding characters, though, apart from the long narrow head of *D. hilli,* measurements alone do not provide much of a guide to the species:

	D. platyurus. From Description.	*D conspicillatus.* Three Specimens.			*D. hilli.* Holotype and Two Others.		
Length..	60	61	61	73	60	68	66
Snout to vent .	44	46	42	54	44 5	48	50
Snout to ear ..	10	9 5	—	—	10	10	9
Head, width .	9	8 5	8 5	9	7 5	8	8
Fore limb ..	13	16	16	16	13 5	14	14
Hind limb .	16	18	18 5	18	16	15	15
Tail, width	11	11	—	—	9 5	11	11

I find that the only conspicuous differences lie in the body scaling, and they might be summed up as follows:

D. hilli, 1 shield between the nasals, dorsal and mid-ventral scales about equal in size, laterals smallest.

D. conspicillatus, 1 shield between the nasals, dorsal scales largest, laterals smallest.

D. platyurus, 2 shields between the nasals, dorsal scales largest, ventrals and laterals equal, smaller.

Very few specimens are known, and it will be seen from the above that, were a large series available, the results of an examination would prove most interesting, more particularly because of the widely separated localities of those already known.

D. hilli has already been recorded from Darwin and Queensland, *D. conspicillatus* from Charlotte Waters, central Australia, and *D. platyurus* from Torrens Creek, north Queensland. In the Australian Museum collection is one *D. conspicillatus* from Lawler, and two, which I place as *D. hilli,* from Kalgoorlie; both these localities are in Western Australia.

DIPLODACTYLUS TESSELLATUS *Günther.*

Diplodactylus tessellatus Boulenger, Brit. Mus. Cat. Liz., i, 1885, p. 103, pl. viii, fig. 6. *Id.*, Stirling and Zietz, Trans. Roy. Soc. South Australia, xvi, 1893, p. 160.

I have examined a series of fifty-two specimens of this species from somewhere on the Darling River, New South Wales, collected during the flood of 1890.

There is practically no variation from type, except that the cones on the tail, which are not mentioned by Boulenger, but which were noted by Stirling and Zietz, may be in a paired series extending the whole length of the tail or may be confined to a few pairs near the extremity. The series ranges in length from 42 mm. to 75 mm. I collected a single specimen under a loose boulder on a small rocky ridge, in very dry country some thirty miles north of Broken Hill, in August, 1928.

LEPIDODACTYLUS GUPPYI *Boulenger.*

Lepidodactylus guppyi Boulenger, Proc. Zool. Soc. Lond., 1884, p. 210. *Id.*, Kinghorn, Rec. Austr. Mus., xvi, 3, 1928, p. 158, fig. 28.

Since writing my paper on the herpetology of the Solomon Islands, when this species was unknown to me, a single specimen has been collected at Roviana, and presented to this Museum by Mr. M. S. Stanley in January, 1928. The locality constitutes a new record for the distribution of the species, as previously it was known only from Faro Island. It does not differ in any essential from Boulenger's description, but the colour is interesting. It is very pale, almost creamy white above and below; there is a dark marking through the loreal region and eye, which fades away near the shoulder. There are ten small dark spots along the median dorsal line, and the pale bars on the labials are formed by tiny dots: there also are some pale markings on the top of the head.

Mr. Stanley found this little gecko (a very rare species) crawling up the wire netting fence at night, outside the house in which he was a guest.

VARANUS GOULDI *Gray.*

An exceedingly beautifully marked young specimen of this species from Kootingal, New South Wales, was presented to the Museum by Mr. N. E. Campbell. The dorsal surface is a rich tan, crossed by dark bands, there being fifteen of these between the shoulder and the groin. The tip of the tail is tan, and the basal portion barred alternately with rich brown and lemon-yellow cross

bars. The head is tan above and yellow on the sides, with a dark brown band from the eye to the nape, and another from the nostril to the side of the neck, the space between these bands being lemon-yellow. The underparts are whitish, the chin and throat dark spotted.

DEMANSIA ORNATICEPS *Macleay*.

Elapocranium ornaticeps Macleay, Proc. Linn. Soc. N.S.W., ix, 1884, p. 560.

Diemenia ? ornaticeps Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 324.

Having examined Macleay's specimen, the holotype, which is in the Macleay Museum, Sydney University, I can confirm Boulenger's identification, but as the synonymy has been changed since the compilation of his catalogue, the species now stands as *Demansia ornaticeps*.

DENISONIA FORRESTI *Boulenger*.

Demansia forresti Boulenger, Ann. Mag. Nat. Hist., (7), xviii, 1906, p. 440.

It appears to me that this species is synonymous with *Denisonia suta* Peters, the only outstanding difference being the number of scale rows. Unfortunately the type is not available to me, as, I understand, it is in the Berlin Museum. I would suggest that it be examined and compared with *D. suta*, in conjunction with a previous paper of mine in which I declared *D. frenata, D. frontalis*, and *D. stirlingi* to be synonymous with *D. suta*.[1]

DIPSADAMORPHUS FUSCUS *Gray*.

Dipsas ornata Macleay, Proc. Linn. Soc. N.S.W. (2), iii, 1888, p. 416. Boulenger, Brit. Mus. Cat. Snakes, iii, 1896, p. 81.

Boulenger, in regarding Macleay's description as insufficient, was doubtful whether this species belonged to the genus *Dipsadamorphus,* though he felt that that was the genus to which it should be referred.

I have examined Macleay's specimen and find that it has 19 rows of scales and not 15, as in his description, probably a misprint. The dentition and all external characters show that, without any doubt, it is identical with *Dipsadamorphus fuscus* Gray.

Macleay's specimen is from King Sound, north-west Australia.

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[1] Kinghorn.—Rec. Austr. Mus., xiii, 3, 1920, p. 110.

A NEW GENUS AND SPECIES OF BAT (KERIVOULINÆ) FROM THE SOLOMONS, WITH A REVIEW OF THE GENERA OF THE SUB-FAMILY.

By

ELLIS LE G. TROUGHTON,
Zoologist, The Australian Museum.

(Figure 1.)

A small but extremely interesting collection of bats was recently presented to the Australian Museum by Mr. J. H. L. Waterhouse, F.R.A.I., Headmaster of the School and Training College of the Methodist Mission at Roviana Island in the New Georgia Group of the Solomon Islands. They were secured with a view to obtaining ectoparasites as well as enriching the collection of Chiroptera, and the donor's trouble was rewarded in both respects. One of the bats proved to be of exceptional interest, a complexity of characters rendering allocation to its sub-family somewhat difficult, and involving the description of a new genus and species for its reception.

External features and dentition, with the skull *in situ*, suggested affinity with the genus *Myotis* (Vespertilioninæ), but the specific characters were not reconcilable with *moluccarum* Thomas,[1] the only species of that genus said to extend to the Solomons. It may be noted, however, that Thomas did not give details of the material on which this record was based, and, as the coloration of his species coincides generally with that of the new form, it is conceivable that his Solomon Island representatives may be identical with it, the distinction being easily overlooked in a superficial examination.

Closer examination and dissection to expose the sternum and its five attached ribs prove conclusively that the Roviana specimen belongs to the following sub-family, as defined by Miller, though apparently not reconcilable with any known genus within it.

Sub-family KERIVOULINÆ.

1878. *Vespertiliones* Dobson, Cat. Chiropt. Brit. Mus., p. 168 (part).

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[1] Thomas.—Ann. Mag. Nat. Hist. (8), xv, 1915, p. 170.

1891. *Vespertilionidæ* (part; Vespertilionine division, part) Flower and Lydekker, Mammals, living and extinct, p. 661.

1907. *Kerivoulinæ* Miller, Bull. U.S. Nat. Mus., lvii, pp. 197 (key) and 232.

Distribution.—Africa, south of the Sahara; India and the Malay Region; New Guinea and northern Queensland to the Solomon Islands (first record).

Characters.—Externally as in the Vespertilioninæ. Sternum broad and greatly foreshortened, its median length less than twice the breadth of the presternum; median lobe of the presternum small but distinct, upright. Keel of mesosternum low. Only four or five ribs articulate with the sternum.

Principal subdivisions.—The three genera hitherto recognised are *Kerivoula*, *Phoniscus*, and *Chrysopteron*.

Remarks.—The peculiar shortened sternum and number of ribs readily distinguishes the members from those of all other subfamilies of Vespertilionidæ, but the complex inter-relation of minor characteristics between the various genera, and *Myotis* (Vespertilioninæ), renders generic differentiation more difficult.

Prior to Jentink's[2] description of *Chrysopteron* in 1910, the known genera, *Kerivoula* and *Phoniscus*, were characterised by having the premolars well developed, the upper middle one never being minute, and the mandibular ones always subequal. Miller[3] based *Phoniscus* upon the greatly enlarged and peculiarly shaped upper canine and the four-cusped inner mandibular incisor. *Chrysopteron* is distinguished from both these allies by having a minute upper middle premolar internal to the tooth row, and the middle mandibular one considerably smaller than the first, as in species of *Myotis*. It is further distinguished from *Kerivoula* in having the two inner lower incisors four- instead of three-cusped; this feature also distinguishes it from *Phoniscus*, in which only one incisor is four-cusped, though affinity with the latter is thus implied.

As a further complication, the Roviana specimen's premolars definitely ally it with *Chrysopteron*, though the two inner lower incisors are tricuspid as in *Kerivoula*, while the enlargement and grooving of the canine indicates a leaning towards *Phoniscus*. However, the specimen from the Solomons differs from the three allied genera in certain essential characters, and, in view of the present confusion as to the status and affinities of genera and individual species, it seems advisable to make it the type of a new genus, thus assisting the elucidation of complex inter-relationships,

[2] Jentink.—Notes Leyden Museum, xxxii, 1910, p. 74.
[3] Miller.—Proc. Biol. Soc. Wash., xviii, 1905, p. 229.

until there is a complete understanding of the variability and relative value of the characters shown by members of the sub-family.

The new genus may be diagnosed as follows:—

ANAMYGDON *gen. nov.*

Differential characters.—Externally a dull-coloured Kerivoulid, lacking the brilliant orange wing-markings of *Chrysopteron,* to which it is most nearly allied by the possession of a minute, internally placed, upper middle premolar, a character lacking in *Kerivoula* and *Phoniscus.* Clearly differentiated from its nearest ally, *Chrysopteron*, by the combination of these characters:—two inner lower incisors tricuspid; 1st and 2nd phalanges of the 3rd digit subequal. In *Chrysopteron* these incisors are four-cusped, and the 1st phalanx is decidedly longer than the 2nd (6·7 mm.). Ears simple in outline, without the deep concavities in the hinder margin existing in both species of *Chrysopteron.* Forearm 38·5 mm. (One species. *Habitat*: Solomon Islands.)

Skull.—Braincase not quite as elevated as in *Kerivoula* and *Phoniscus*, but apparently more so than in *Chrysopteron*, described as "flat, not inflated"; there is a low but definite sagittal crest, not present in the two former. Rostrum short and broad, considerably shorter than braincase. Nares differently shaped to those of *Kerivoula*, more acutely angled posteriorly, though comparatively broader, as in *Phoniscus*; viewed from above, the greatest breadth of the aperture appears equal to or very slightly less than its length, instead of scarcely, or not half the length as in *Kerivoula.* The width is rather greater than the length in *Phoniscus.*

Dentition.—Formula as in the allied genera.

Upper series.—Both incisors bicuspidate and almost equal in height, the outer one separated from the canine by a decided space about equal to the anterior width of the incisor. Canine long and strong, its appearance suggesting that described for *Phoniscus*; the point extending well beyond the cingulum (about ¾ mm.) of the opposing canine when jaws are closed. The inner side of the tooth strikingly flattened, even concave; a well defined longitudinal groove in front, and a decided posterior cutting edge. Middle premolar (p^3) minute, internally placed. Molars as described by Miller for *Kerivoula* and *Phoniscus*,[4] m^1 and m^2 without hypocone, m^3 with metacone and three commissures well developed. Cingula well developed around the inner side of m^1 and m^2.

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[4] Miller, 1907, particularised only those characters of *Phoniscus* which contrasted with *Kerivoula*, the inference being that there is similarity in the other features.

Lower series.—Two inner incisors tricuspid, not imbricated, except that the outer cusp of i_2 slightly overlaps i_3; i_3 bulky, nearly as wide as long, higher than others and with four definite cusps, two outward and two inwardly placed. Premolars not subequal, the middle small, barely half as high and about one-quarter the bulk of p_1; p_4 somewhat larger and decidedly higher than p_1, about two-thirds the height of canine. Molars differing from *Kerivoula* and *Phoniscus* in showing a decided contrast in the height of the protoconid and hypoconid in m_1 and m_2, the hypoconid about three-quarters the height of protoconid.

Palate-ridges.—Seven, including three anterior undivided ridges, followed by four divided ones, and a short undivided one posteriorly.

External characters.—General coloration dark, without contrasted markings on the membranes. Ear reaching the nostril when laid forward, without deep emargination in the hind border. Tragus long, broadly convex in outer lower two-thirds, the tip attenuated. Third and fourth metacarpals about equal, the fourth a fraction longer, instead of slightly shorter (*Kerivoula* and *Phoniscus*) and decidedly (3 - 4·5 mm.) shorter (*Chrysopteron*). 1st and 2nd phalanges of 3rd digit subequal, the 2nd a fraction the longer, contrasting with *Chrysopteron* in which it is definitely shorter (6 - 7 mm.) than the 1st.

Affinities.—Though *Anamygdon* is allied to *Chrysopteron* by its minute p^3 and unequal lower premolars, the characters separating them are definite and so complexly intermingled with those of the allied genera as to suggest that the new form has been independently derived. Principal claims to distinction are the absence of crowding or marked imbrication of the lower incisors, of which the inner two are three- and not four-cusped; also in the marked differences in the relative lengths of the metacarpals and phalanges compared with those of its allies, and the complete absence of bright fur and contrasted wing coloration. In support of the theory of independent development, these differential characters may possibly illustrate the effect of habits resulting from isolation in a different environment. For instance, decided crowding and imbrication of the lower incisors in *Chrysopteron* implies shrinkage of the mandible anteriorly, which, associated with the two four-cusped inner incisors, probably indicates differences of diet and feeding habits. Furthermore, the marked contrasts in metacarpal and phalangeal dimensions noted above are possibly due to the more restricted insularity of the Solomon Island genus. In this respect the brilliant coloration of both species of *Chrysopteron* is also of some theoretical importance. Jentink has drawn attention to "an interesting biological observation" published in 1900[5] con-

[5] Flower.—Proc. Zool. Soc., 1900, p. 347.

cerning a Siamese specimen of the similarly coloured *Kerivoula picta* which says: "Orange-colored bat from a Swamp called Bang Falari at the Rangsit Canal: *it sleeps in the flower of the Calæ Lilly.*" The italics are Jentink's, who remarked "It sounds like a wonderful tale, a golden and red and black colored bat sleeping in a Lilly-flower." It is reasonable to suppose that the parallelism shown in the equally brilliant coloration of *Chrysopteron,* which likewise extends to the membranes and ears, is proof of the adoption of similar habits involving a need for the same protective coloration; thus the sombre colour of the fur and membranes of *Anamygdon* is an additional indication of independent development in a different environment.

In brief review, it may be pointed out that the relative proportions of the phalanges of the 3rd digit separates *Anamygdon* from both *Chrysopteron* and *Kerivoula*; detailed dimensions of the phalanges of *Phoniscus* are not available. The definite sagittal crest of *Anamygdon* is lacking in *Kerivoula* and *Phoniscus*, a feature not dealt with by Jentink for *Chrysopteron*. On the contrary, the shape of the nares of *Anamygdon* is markedly different to that of *Kerivoula*, but apparently quite like that of *Phoniscus*; as yet undescribed for *Chrysopteron*. The lack of marked imbrication of the lower incisors appears to ally the two forms having these inner teeth three-cusped.

Interesting queries arising are as follows: In *Chrysopteron*, is the upper outer incisor separated from the canine by a decided space, is the upper canine grooved anteriorly and flattened internally, what is the relative width and length of the nares viewed from above, and is there a definite sagittal crest? What are the detailed dimensions of the wing-parts of various species of *Phoniscus*? Whatever the answers to these queries, there seems little doubt that the Solomon Island specimen represents a distinct generic form which has evolved independently at the southern extremity of the sub family's range.

Genotype.—Described below.

ANAMYGDON SOLOMONIS *sp. nov*

(Figure 1.)

A small, dull-coloured species without contrasted markings; the ear simple in outline, without deep emargination behind. Both upper incisors are bicuspidate, the outer one separated from the canine by a decided space. Greatest length of skull 15·4 mm. Forearm 38·5 mm.

External characters.—Ear narrowly oval, when laid forward reaching but not surpassing the nostril, the outline simple (much as figured for *M. adversus*); a slight notch in the middle of the outer

margin not seen in figures of that species, but no trace of the deep emargination described in species of the allied genera. The inner margin has a slight emargination succeeding its commencement, thence broadly and evenly convex in its upper two-thirds, the tip not emphasised by a flattening in front or a notch behind. Tragus with inner margin somewhat curved, slightly concave in lower and convex in upper fourth; outer margin serrated, the tip attenuated owing to the gradual but deep emargination of the upper fourth, thence evenly convex to its greatest width, opposite the base of the inner margin. Below this the outer margin slopes inwards and gives rise to a fleshy sub-triangular lobe at the base. Attachment of wings variable in the holotype, to the middle of metatarsus

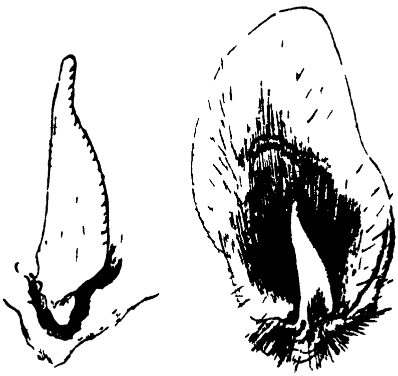

Figure 1

on one side, and the base of the tibia on the other. Calcar extending for slightly less than two-thirds the length of the membrane-margin, the end not free.

Pelage.—Soft and fine, rather sparse over the fore part of the body, densest on the lower back; hairs on shoulders 6·5 - 7 mm., on lower back about 4·5 mm. Face below eye and between it and ear naked save for sparse long hairs, otherwise the lips, except around nostrils, and the snout, are evenly covered with short coarse hairs; forehead and crown well covered with long fur. Owing to the dark colour of the almost naked nasal region the face appears comparatively well furred. Above, the fur extends on to the wings to an irregular line between the upper third of the humerus and middle of the thigh; a few sparse hairs about the knee. Below, the hairs extend outward to about the same line, but long pale hairs are scattered to a line with the elbow. Wings otherwise naked. Interfemoral not very hairy above or below and without a fringe: above, the fur only surpasses the thighs

at their inner thirds in a v-shaped patch extending about 9 mm. along the tail; below, the interfemoral is entirely without hairs which only surpass the line of the thighs by sparsely covering the butt of the tail.

Colour.—Not strikingly bi-coloured, the undersurface decidedly paler but not sharply contrasted. Above, the fur is blackish-brown basally with a wash of sepia (Ridgway, 1912) on the tips, most evident on the lower back; the basal colour somewhat lightened by occasional greyish or sepia-toned hairs. Below, the extreme base of the fur appears whitish under the microscope, otherwise the basal two-thirds is of a somewhat warmer blackish-brown than above, similarly interspersed with lighter hairs; the tips are an uneven tone of light buffy-brown; some whitish avellaneous hairs fringe the inguinal region and the long hairs on the wing are avellaneous. Ears and wings about blackish-brown[3] of Ridgway, the interfemoral lighter. Membranes without trace of the conspicuous markings found in some allied forms.

Skull.—Braincase apparently not as inflated as in *Kerivoula* and *Phoniscus*, but seemingly more so than in *Chrysopteron*, the rostrum short and broad. Nares wide, the width almost equalling the length. Low sagittal crest present.

Dentition.—Upper inner incisor bicuspid, the secondary cusp at about two thirds the height. Outer incisor bicuspid and separated from canine by a space equal to its width, with a decided concave surface directed toward canine; secondary cusp weaker than on inner tooth, formed owing to the extension obliquely upwards of the postero-external cingulum as a stout column terminating in a conical cusp resting against, and a little shorter than cusp of inner tooth. Outer incisor as bulky as inner but about three-quarters its height. Lower incisors not crowded or imbricated, except that the outer cusp of i_2 overlaps the inner one of i_3, the two inner ones tricuspid when viewed from any angle under high power binocular; outer incisor bulky, sub-terete, its antero-posterior width nearly equalling its length and equal to the length of either of the inner two, twice the width of either. Outer incisor higher than others and with four distinct but irregular cusps; a large outer one comprising almost half the crown, one antero-internally, and two postero-internally. Upper canine strongly flattened internally and with a decided groove anteriorly, traversing the upper two-thirds of tooth, also a posterior cutting-edge. Upper p^1 small, barely half the height of p^4 and about one-quarter the bulk; p^3 minute, rounded, flattened from above, internal to the tooth-row and not exceeding the height of the cingula of p^1 and p^4 which are in contact, therefore it is not visible from without. Lower p_1 decidedly larger than upper, p_3 half its height and about one-third its bulk; p_4 about one-quarter higher than p_1 and about two-thirds the height of canine.

Dimensions (the holotype in spirits, and its skull) :—

Forearm, 38·5 mm.

Head and body, c45; tail, 35·5; ear (inner edge), 11·5; tragus (inner edge), 5·8; tibia, 14·5; hind foot (c.u.), 10·2; calcar, 14·2. Complete dimensions, see table on p. 99.

Skull: Greatest length 15·4; zygomatic breadth, 9·8 – 10; breadth of braincase, 7·9; front of canines to back of m^3, 6; front of p^4 to back of m^2, 3·7.

Hab.—The Solomon Islands. Holotype from Roviana Island, New Georgia Group.

Holotype.—Adult female. Australian Museum No. M.4361. Collected in 1928 by Mr. J. H. L. Waterhouse, F.R.A.I.

Remarks.—Although characters already detailed render comparison with the forms of allied genera superfluous, some points of superficial differentiation from geographical neighbours may simplify the work of others. From *Myotis moluccarum*, said by Thomas to extend to the Solomons, which has a general similarity in colour and, apparently, dentition, it is superficially distinguished by its smaller foot which is 10·2 instead of 13, and shorter tibia, 14·5 instead of 17·5 mm. From *Kerivoula myrella* of the Admiralty Islands and Bismarck Archipelago it is readily distinguished by the simple outline of the ear, the hinder margin lacking a deep emargination in its upper fourth, and the bicuspid, instead of unicuspid, inner upper incisor.

My best thanks are due to Mr. Waterhouse for the opportunity to describe this interesting new form from the Solomons, which I have done in considerable detail in the hope that it will assist workers with more comprehensive material to unravel the uncertain affinities of allied forms. In this regard it may be pointed out, with all deference, that the brevity of overseas descriptions of local forms, associated with the lack of figures, often greatly increases the difficulties of local workers, involving unnecessary labour which might be considerably reduced if the wide knowledge of admitted authorities were published in more detailed form.

I am indebted to Miss Joyce K. Allan for preparing the single text-figure.

Key to the genera of KERIVOULINÆ.

A. Premolars evenly developed; the upper middle one never minute, mandibular ones subequal.

a. Upper canine normal; inner lower incisor with three cusps. Nares narrow, width viewed from above scarcely or not half length .... *Kerivoula* Gray

b. **Upper canine elongated, laterally compressed; a marked groove anteriorly; inner lower incisor with four cusps. Nares broader, width rather greater than length .... *Phoniscus* Miller**

B. **Premolars markedly uneven; upper middle one minute, mandibular ones very unequal, the middle one about half the height of the first, which is smaller than the last.**

c. **Lower incisors crowded and much imbricated, the inner and second ones with four cusps. 1st phalanx of 3rd digit decidedly longer than 2nd phalanx .... *Chrysopteron* Jentink**

d. **Lower incisors not crowded, only outer one slightly imbricated, inner and second ones three-cusped. 1st phalanx of 3rd digit subequal with 2nd phalanx .... *Anamygdon* gen. nov.**

A Brief Review of the Allied Genera and Their Forms.

Genus Chrysopteron *Jentink.*

1910 *Chrysopteron* Jentink, Notes Leyden Museum, xxxii, p. 74.
Genotype.—Kerivoula weberi Jentink.

Range and number of forms.—Jentink has described two brilliantly coloured forms with orange wing-markings, the genotype "*Kerivoula*" *weberi*[*] being from South Celebes, and *bartelsii*, from the 10,000 ft. top of the Pangerango Mountain, Java, described when the genus was founded.

Diagnosis.—Separated from *Kerivoula* and *Phoniscus* by the markedly uneven premolars, the upper middle one being minute, and the mandibular ones very unequal, and from its nearest ally, *Anamygdon*, by having the lower incisors crowded and much imbricated, with the two inner ones (i_{1-2}) four-cusped, and by the 1st phalanx of the 3rd digit being decidedly longer than the 2nd.

General remarks.—The description of *weberi* stated that its size distinguished it from any other *Kerivoula*, the forearm-length, given as 59 mm., being said to surpass that of any other member of the genus by about an inch, but the dimension quoted was subsequently amended by Jentink to 49 mm.

In describing *bartelsii* Jentink emphasised that it is larger in all dimensions than *weberi* [excepting the subequal hindfoot], but as the single representatives were of opposite sexes, uniformly smaller dimensions could have been compatible with differences of sex or age, and not necessarily of specific importance, while other superficial differences might have been due to similar causes. However, certain features mentioned by Jentink apparently leave no doubt of either species' validity, as in addition to differences of colour arrangement, there is a freely projecting end to the calcar,

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[*] **Jentink.—Weber's Zool. Ergebnisse Niederl. Ost-Indien, i, 1890, p. 129, pl. xi.**

and a well-developed internal cusp on the outer upper incisor in *weberi*, not present in *bartelsii*.

The latter feature is not only the main differential character, but its presence or absence in the two forms of the genus is of significance concerning the relative generic importance of similar dental features, the inference being that as the four-cusped inner two lower incisors are constant in both species, their value as a generic character separating *Chrysopteron* from its allies appears to be established. Correspondingly, the generic value of the character has a distinct bearing upon the status of *Anamygdon*, the nearest ally, in which the inner two lower incisors are three-cusped. Furthermore, the size of the middle lower premolar in Jentink's two species appears to be variable, while the reduced middle upper one is consistently minute, thus indicating the stability of this character as a generic one allying *Chrysopteron* with *Anamygdon*, and separating both from *Kerivoula* and *Phoniscus*.

The canines of *bartelsii*, and presumably of *weberi*, were described as "strong, especially the upper ones," indicating a certain accord with those of *Phoniscus* and *Anamygdon*, though the description leaves doubt as to the extent of the similarity.

A possible third species of *Chrysopteron* was indicated by Jentink in 1910 (*loc. cit.*, p. 76) in *Vespertilio formosus* Hodgson,[7] later figured by Tomes,[8] which Jentink says "presents the same beautiful mode of coloration as *Weberi* and *Bartelsii*; it very likely is a species of our new genus *Chrysopteron*." He points out, however, that the teeth of *formosus* have not been sufficiently studied to decide the matter with any certainty and that he never saw a true specimen of it.

Key to the species of CHRYSOPTERON.

A. Outer upper incisor with a well-developed cusp internally. End of calcar freely projecting .... *weberi*

B. Outer upper incisor without a cusp internally. End of calcar not free or projecting .... *bartelsii*

Genus KERIVOULA *Gray*.

Synonymy and diagnosis.—See Miller, Bull. U.S. Nat. Mus., 1907, p. 232, "The families and genera of bats," adding this reference, Jentink, Notes Leyden Museum, xxiv, 1904, p. 174-5, in which numerous references are quoted and the spelling of "*Kerivoula*" is supported.

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[7] Hodgson.—Journ. Asiatic Soc. Bengal, iv, 1835, p. 700.

[8] Tomes.—Proc. Zool. Soc., 1858, pl. lx.

Logotype.—Vespertilio hardwickii Horsfield.

Geographic distribution.—Africa, south of the Sahara; India and the Malay Region; New Guinea and adjacent islands; Admiralty Islands and Bismarck Archipelago.

Number of forms described.—In 1878 Dobson listed the following ten species in his British Museum Catalogue; *aerosa*, *africana*, *brunnea*, *hardwickii*, *jagorii*, *lanosa*, *papillosa*, *papuensis*, *pellucida*, *picta*. In 1907 Miller (*loc. cit.*) gave the recognised forms as eighteen but named only the species actually examined, making an addition of three to Dobson's list. Jentink (*loc. cit.*, 1910), however, added but six additional forms to that list, *i.e.*, *smithii*, *javana* 1880, *harrisoni* 1900, *pusilla* and *whiteheadi* 1894, of Thomas, and *minuta* of Miller 1898. The following six, overlooked by Jentink, were also described prior to 1910—*bicolor* 1904, *muscilla* and *picta bellissima* 1906, of Thomas, *depressa* and *engana* 1906 of Miller, and *agnella* 1908 of Thomas. The nine forms described since 1910 are *bombifrons* Lyon 1911, *cuprosa* and *phalaena* Thomas 1912, *crypta* Wroughton and Ryley 1913, *myrella* 1914, *flora* and *lenis* 1916, of Thomas, *lucia* Hinton 1920, and *nidicola zuluensis* Roberts 1924. The total number of forms originally allotted to *Kerivoula*, so far as I am aware, is therefore thirty-two, counting the typical form of *nidicola*.

General remarks.—Jentink (Notes Leyden. Mus., 1910) provides instructive notes upon the sixteen species listed, and stresses the difficulty involved in a critical examination of the lower incisors, to which he attributes the failure of authors adequately to describe the important cusps. The incomplete Australian Museum material, as well as the incomprehensive descriptions of individual species, precludes any attempt at a general review of the members of this genus but it is hoped that the list of species, with the following brief comment, may assist those more fortunately armed with material.

Of the earlier species listed by Dobson, Jentink has pointed out that *pellucida* has lower incisors typical of *Phoniscus*, and it should apparently be transferred to that genus. Prior to this Jentink (*loc. cit.*, 1891, p. 204) recorded four specimens of *pellucida* from East Sumatra and agreed with Dobson in refuting Tomes' suggestion (P.Z.S., 1858) that the species was identical with *hardwickii*, also supplying characters and dimensions which separate them.

In my opinion, Tomes' *aerosa* with its "long, strong, and angular" canines may also prove to be a *Phoniscus*, while Thomas has confirmed Miller's suggestion, upon examination of the types, that *papuensis* and *javana* are also definitely referable to the allied genus. In his description of *myrella* of the Admiralty Islands and

Bismarck Archipelago, a specimen of which was referred to *hardwickii* by Dobson in 1878, Thomas notes characters in the skull and teeth approaching those of *Phoniscus* and expresses some uncertainty as to how far the status of that genus is affected by such characters, something of which is also found in his *agnella* of St. Aignan Island, S.E. New Guinea. Thomas has stated that his Austro-Malayan *flora* of South Flores has none of the *Phoniscus*-like characters of the two former, and that it is a large ally of *hardwickii*.

Regarding *brunnea*, described as of uncertain habitat (Madras or South Africa) by Dobson in his catalogue, it is of interest to note that Chubb[9] has reported its rediscovery in Portuguese East Africa; the original was not fully adult and in a very faded condition, so that the details of the fresh adult specimen assigned to *brunnea* with the concurrence of Thomas and Andersen, who compared it with the type, are of considerable importance.

The range of *picta* has been increased by the definite recording of a specimen from Sumatra (Deli) by Jentink (*loc. cit.*, 1904) and another from Tirhut, presumably the island in the Persian Gulf, by Inglis,[10] as well as the new subspecies, *picta bellissima* of Thomas, described from South China in 1906.

Excepting only *depressa* Miller 1906 in which the teeth are stated to be not obviously different from *hardwickii*, and *phalaena* Thomas 1912 in which the 1st and 2nd lower incisors are said to be tricuspid, authors since Dobson have usually failed to describe the lower incisors at all. This is most remarkable regarding species described since 1907 when Miller established the generic importance of these teeth. For instance, Lyon in describing *bombifrons* in 1911,[11] which he regarded as "apparently rather closely related" to *pellucida*, which is probably a *Phoniscus*, did not describe the diagnostic lower incisors. There is, in view of many such omissions, little to be said, in a comparative sense, regarding many of the species listed above, and the preparation of a key to the species must be left to someone adequately provided with material.

Genus PHONISCUS *Miller.*

1905 *Phoniscus* Miller, Proc. Biol. Soc. Washington, xviii, p. 229.

1907 *Phoniscus* Miller, Bull. U.S. Nat. Mus., lvii, p. 233 (diagnosis and remarks).

Genotype.—Phoniscus atrox Miller.

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[9] Chubb.—Ann. Transvaal Museum, iii, 1911, p. 56.
[10] Inglis.—Journ. Nat. Hist. Soc. Bombay, xxiv, 1916, p. 354.
[11] Lyon.—Proc. U.S. Nat. Mus., xl, 1911, p. 134.

Geographic distribution.—Eastern Sumatra, Java, Papua, north-eastern Australia.

Review of forms.—*P. atrox* was regarded as the sole species until Thomas,[12] at Miller's suggestion, examined the types of *K. papuensis* Dobson and *K. javana* Thomas and declared "both to be clearly referable to *Phoniscus*." According to Miller (*loc. cit.*, 1907) *papuensis* was amongst the species examined by him and it is remarkable that he retained it in the genus *Kerivoula* characterised by three-cusped inner lower incisors, whereas its subsequent relegation to *Phoniscus* implies the possession of the four cusps then regarded by Miller as typical of his genus. However, Dobson's description of *papuensis* said "all the lower incisors trifid," so that unless he was in error, or Miller's specimen was not authentic, the presence of four-cusped inner lower incisors apparently ceases to be generically characteristic of *Phoniscus*. It is notable that Thomas' *javana*[13] is described as having the teeth "quite similar to those of *K. papuensis*," the inner lower incisors therefore apparently being trilobate, so that the inclusion of these two forms in *Phoniscus* by Thomas suggests that he either did not check the feature, or did not consider it of diagnostic importance. Prior to this inclusion, Jentink (*loc. cit.*, 1910) had regarded the two forms as of the "true *Kerivoula*-genus" characterised by trilobate inner lower incisors.

Regarding *Kerivoula pellucida* Waterhouse, Dobson has described the middle lower incisors as "with four distinct cusps each." According to Miller's key the species would thus appear to be a *Phoniscus* as already indicated by Jentink (see above, genus *Kerivoula*). However, the relegation of forms with trilobate inner lower incisors to *Phoniscus*, coupled with the inference that the canines of *pellucida* were not unusual, as neither Waterhouse nor Dobson remarked upon them, affects not only the generic position of the species, but the status of the genus also.

In my opinion, *Kerivoula aerosa* of the eastern coast of South Africa, known only from Tomes' description,[14] is quite possibly a *Phoniscus*, as it was described as having the "Upper canines long, strong, and angular" and the outer upper incisor minute as in *papuensis*, which, being also small in *pellucida*, may later prove to be a generic character for *Phoniscus*; though the characters of the lower incisors were overlooked by Tomes, they have not been described for most of the later species. For example, as pointed out under the genus *Kerivoula*, Lyon described *K. bombifrons* as "apparently rather closely related" to *pellucida* which has the lower

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[12] Thomas.—Ann. Mag. Nat. Hist., (8). xiii, 1914, p. 439

[13] Thomas.—Ann. Mag. Nat Hist, (5). v, 1880, p. 472.

[14] Tomes.—Proc. Zool. Soc., 1858, p. 333

incisors originally characteristic of *Phoniscus*, but he did not describe these teeth for his species.

As already noted, Thomas (*loc. cit.*, 1914) described *K. myrella* of the Admiralty Islands and Bismarck Archipelago as being "readily distinguishable by the enlargement of its canines, a development which reaches its extreme in the great sabre-like canines of *Phoniscus*." He further says, "Indeed, I do not feel sure how far the status of *Phoniscus* as a distinct genus will be affected by the condition found in *K. myrella* and *agnella*, in each of which something of its character is shown."

Generic status.—As *papuensis* and *javana*, which apparently possess canines typical of *Phoniscus* and the trilobate inner lower incisors of *Kerivoula*, have been relegated to *Phoniscus*, and *pellucida* with these teeth four-cusped as in *Phoniscus* apparently has the normal canines of *Kerivoula*, the status of the genus appears to be considerably weakened and may largely depend upon the condition of the canines in *pellucida*, undescribed hitherto. Thus, it seems evident that the major characteristics of *Phoniscus* are present in one degree or another in several forms of *Kerivoula* to an extent which strongly suggests that the genotype, *P. atrox*, may represent an extreme form in which these characteristics are brought together in their most concentrated state.

In the absence of essential material it may be suggested that examination of the canines of *pellucida*, and of the incisors of *aerosa*, should authentic specimens become available, together with a comparison of the phalangeal dimensions of those forms and of *papuensis* and *javana*, might possibly serve to confirm their association with *atrox* as isolating the genus *Phoniscus*. However, for the reasons cited, it is more probable that the characters reviewed above may so intergrade as to merge *Phoniscus* with its nearest ally, *Kerivoula*.

Summary of Genera.

The new genus, *Anamygdon*, appears to represent a branch of the Kerivoulinæ nearest to the Vespertilioninæ, and it is not clear, upon the material and records available, to what extent its characteristics affect the sub-family relationships, or those of the three allied genera. However, *Anamygdon* is clearly differentiated from its nearest ally *Chrysopteron*, and from *Kerivoula*, though it is possible that further examination of some of the Kerivoulids more local to Australia may show them to be reconcilable to *Anamygdon*, or lead to the elucidation of the uncertain position of *Phoniscus* regarding those forms considered intermediate between it and *Kerivoula*.

Dimensions of the Species of *Anamygdon* and *Chrysopteron*.

	Anamygdon solomonis Roviana, New Georgia, Solomons.	*Chrysopteron weberi bartelsii.*	
		Celebes.	Java.
	♀	♂	♀
Forearm	38·5	49	53
2nd digit—Metacarpal	33	46·5	51
1st phalanx	2·5	3·5	5
3rd digit—Metacarpal	34·5	47·5	53
1st phalanx	13·5	20	22
2nd ,,	13·8	14	15
3rd ,,	5·8	5·5	5
4th digit—Metacarpal	34·7	43	50
1st phalanx	9·5	13·5	14
2nd ,,	10·3	11	14
5th digit—Metacarpal	34·5	44	49
1st phalanx	9	12	13
2nd ,,	7·8	9·5	10
Ear—Inner edge	11·5	—	—
Outer edge	13	16·5	20
Flattened	7·8	—	—
Tragus—Inner anterior edge	5·8	—	—
Outer posterior edge	7·3	9	10
Head and Body	c45	—	—
Tail	35·5	42·5	43
Tibia	14·5	25	27
Foot, s.u.	8·3	—	—
,, c.u	10·2	12	12
Calcar.	14·2	14	16

EXPLANATION OF PLATE XXV.

Unless otherwise mentioned illustrations are ⅔ natural size.

Astartila cyclas Dana.

Fig. 1. Internal cast of united valves. Lateral view, showing anterior adductor muscle impression and flattened area on umbonal region; A.M., Reg. No. L.648.*

Fig. 2. Complete shell* showing external sculpturing; A.M., Reg. No. L.649. ¾ natural size.

Fig. 3. Lateral view of a weathered valve, showing sculpturing and portion of hinge line; A.M., Reg. No. F.21080.

Fig. 4. Internal cast. Lateral view, showing flattened area and excavate muscle scar; A.M., Reg. No. F.7859.

Astartila obliqua sp. nov.

Fig. 5. Internal cast of united valves, showing marking on internal surface of valve, holotype; A.M., Reg. No. F.1288. ¾ natural size.

Fig. 6. Complete shell. Lateral view with test still attached; A.M., Reg. No. F.21087.

Fig. 7. Lateral view of a specimen with portions of test removed; A.M., Reg. No. F.16989. ⅞ natural size.

Astartila danai De Koninck.

Fig. 8. Complete testiferous valve, showing ornamentation; A.M., Reg. No. F.20996.

Fig. 9. Lateral view of a smaller specimen showing angle of beak; A.M., Reg. No. F.22015.

Fig. 10. Complete specimen, slightly distorted; A.M., Reg. No. F.20994.

Fig. 11. Lateral view of right valve; A.M., Reg. No. F.21001.

Astartila cytherea Dana.

Fig. 12. Lateral view of a cast of the left valve; A.M., Reg. No. L.644. ¾ natural size.*

Fig. 13. Lateral view of right valve, showing flattened area on internal cast; A.M., Reg. No. F.21102.

Fig. 14. Profile of internal cast, showing distance between beaks and hinge line; A.M., Reg. No. F.21124.

Fig. 15. Perfect internal cast. Lateral view of left valve, showing muscle scar and flattened area on umbonal region; A.M., Reg. No. F.21082.

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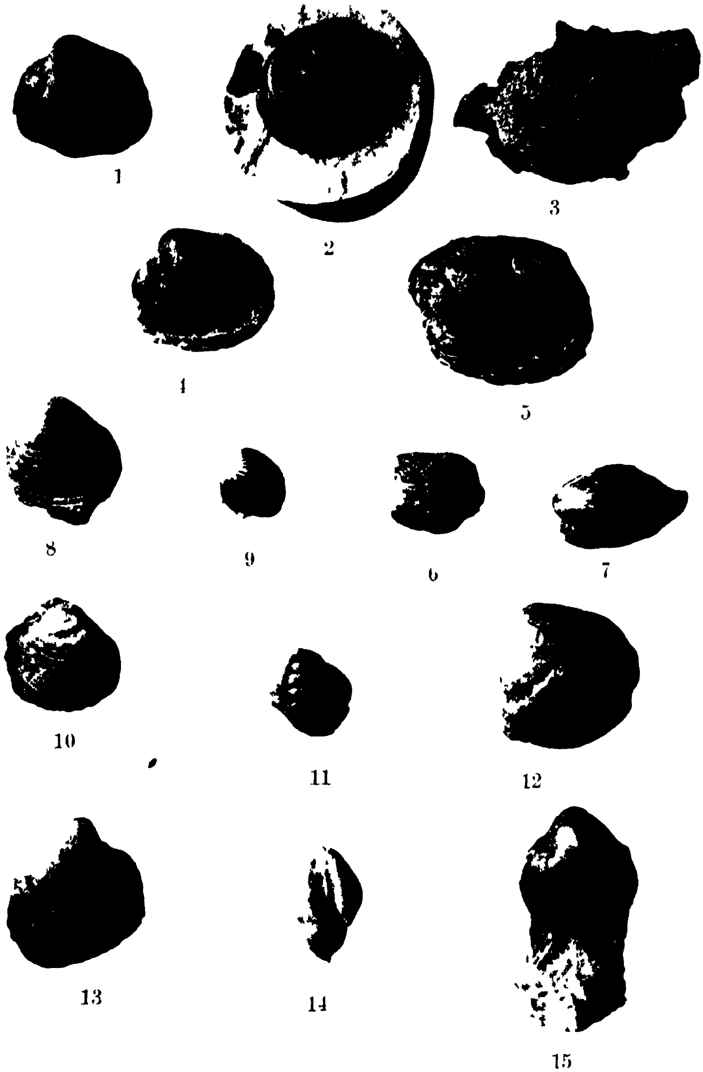
* These specimens are plaster casts of Dana's types; many of the originals were published in Wilke's "United States Exploring Expedition during the years 1838-42," [Vol. x] Geology, Atlas (1849). As this publication is comparatively rare, the casts, which are perfect replicas, are figured herein.



I. C. Clutton, photo.

EXPLANATION OF PLATE XXVI.

Unless otherwise mentioned illustrations are $\frac{3}{5}$ natural size.

Astartila cytheria Dana.

Fig. 1. Complete testiferous specimen, showing heavy ornamentation; A.M., Reg. No. L.643. $\frac{2}{3}$ natural size.*

Astartila corpulenta Dana.

Fig. 2. Slightly distorted specimen of right valve; A.M., Reg. No. F.21025. $\frac{3}{4}$ natural size.

Fig. 3. Right valve with portion of left valve; A.M., Reg. No. F.21066. $\frac{5}{8}$ natural size.

Fig. 4. Cast of internal left valve; A.M., Reg. No. L.635. $\frac{3}{4}$ natural size.*

Fig. 5. Lateral view of a right valve; A.M., Reg. No. F.21016. $\frac{3}{4}$ natural size.

Astartila intrepida Dana.

Fig. 6. Specimen of left valve with portion of outer test removed, showing flattened portion of umbonal region and excavate adductor muscle impression; A.M., Reg. No. L.638.*

Fig. 7. An internal cast of left valve; A.M., Reg. No. F.2251.

Fig. 8. An example of the right valve; A.M., Reg. No. F.21035. $\frac{5}{8}$ natural size.

Astartila polita Dana.

Fig. 9. An internal cast of the left valve; A.M., Reg. No. L.645.*

Fig. 10. Internal cast of both valves, seen in profile; A.M., Reg. No. L.646.*

Fig. 11. Internal cast of left valve. A lateral view showing the upright beak; A.M., Reg. No. F.1131.

Fig. 12. Internal cast of right valve; A.M., Reg. No. F.21047. $\frac{2}{3}$ natural size.

Astartila transversa Dana.

Fig. 13. An internal cast of a left valve, showing excavate muscle scar; A.M., Reg. No. F.21067. $\frac{5}{8}$ natural size.

Fig. 14. An internal cast of a right valve, showing flattened portion of the umbonal region and depressed beak; A.M., Reg. No. L.650.*

Fig. 15. Internal cast of complete valves, seen in profile; A.M., Reg. No. F.21069.

Fig. 16. Internal cast of right valve, showing large posterior adductor muscle scar and depressed beak; A.M., Reg. No. F.21072.

Fig. 17. An internal cast of complete valves. Lateral view of the left valve; A.M., Reg. No. F.21151.

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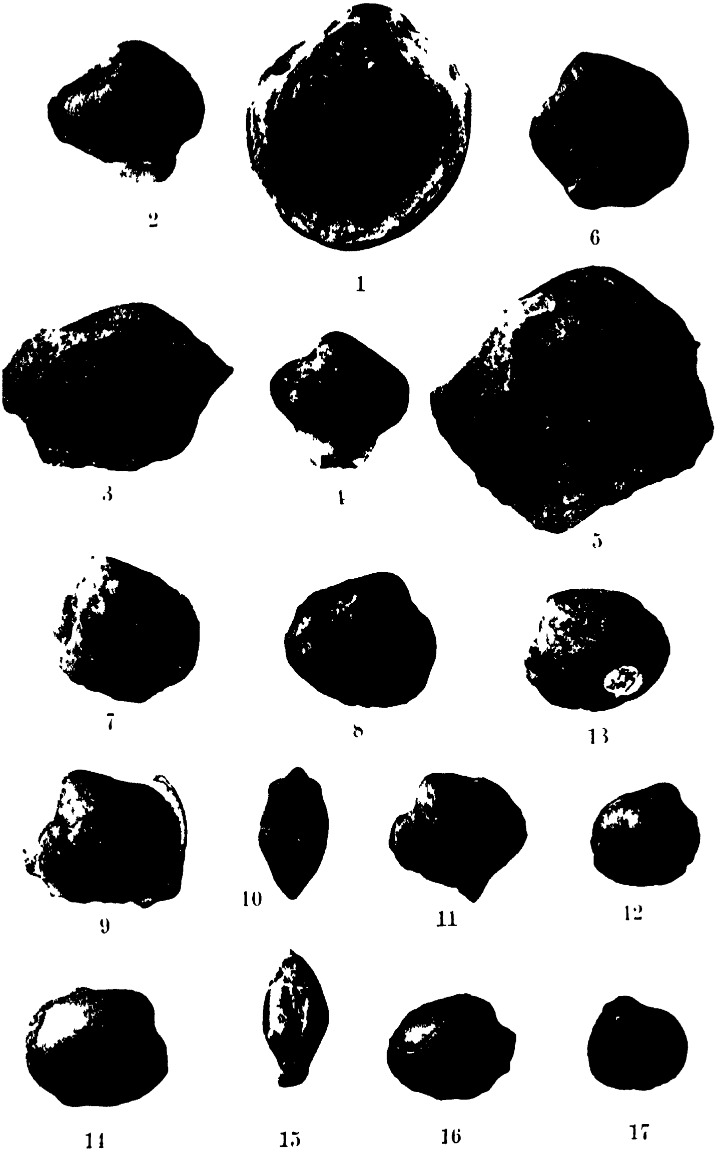
* See footnote to explanation of Plate xxv.



G. C. Clutton, photo.

EXPLANATION OF PLATE XXVII.

Unless otherwise mentioned illustrations are $\frac{2}{3}$ natural size.

Astartila ovata sp. nov.

Fig. 1. Internal casts of a right and a left valve enclosed in matrix holotype; A.M., Reg. No. F.21126.

Fig. 2. An internal cast of a right valve, showing the small excavate anterior adductor muscle impression; A.M., Reg. No. F.24300. $\frac{1}{2}$ natural size.

Fig. 3. An internal cast of a right valve; A.M., Reg. No. F.21149. $\frac{1}{2}$ natural size.

Fig. 4. An internal cast of right valve, showing faint flattened area on umbonal region; A.M., Reg. No. F.21143.

Fig. 5. An example of the more or less depressed type, which lacks the flattened region. Showing posterior and anterior adductor scars; A.M., Reg. No. F.21040.

Astartila quadrata sp. nov.

Fig. 6. A complete specimen, showing external marking. A lateral view of the left valve; A.M., Reg. No. F.22017.

Fig. 7. A specimen seen in profile, showing wide and pronounced external ligament holotype; A.M., Reg. No. F.21199.

Fig. 8. A complete specimen, showing median position of beak; A.M., Reg. No. F.1130.

Astartila delicatula sp. nov.

Fig. 9. A lateral view of a right valve, showing delicate ornamentation; A.M., Reg. No. F.23800. $\frac{3}{4}$ natural size.

Fig. 10. An internal cast of right valve, showing internal ornamentation of shell; A.M., Reg. No. F.23801.

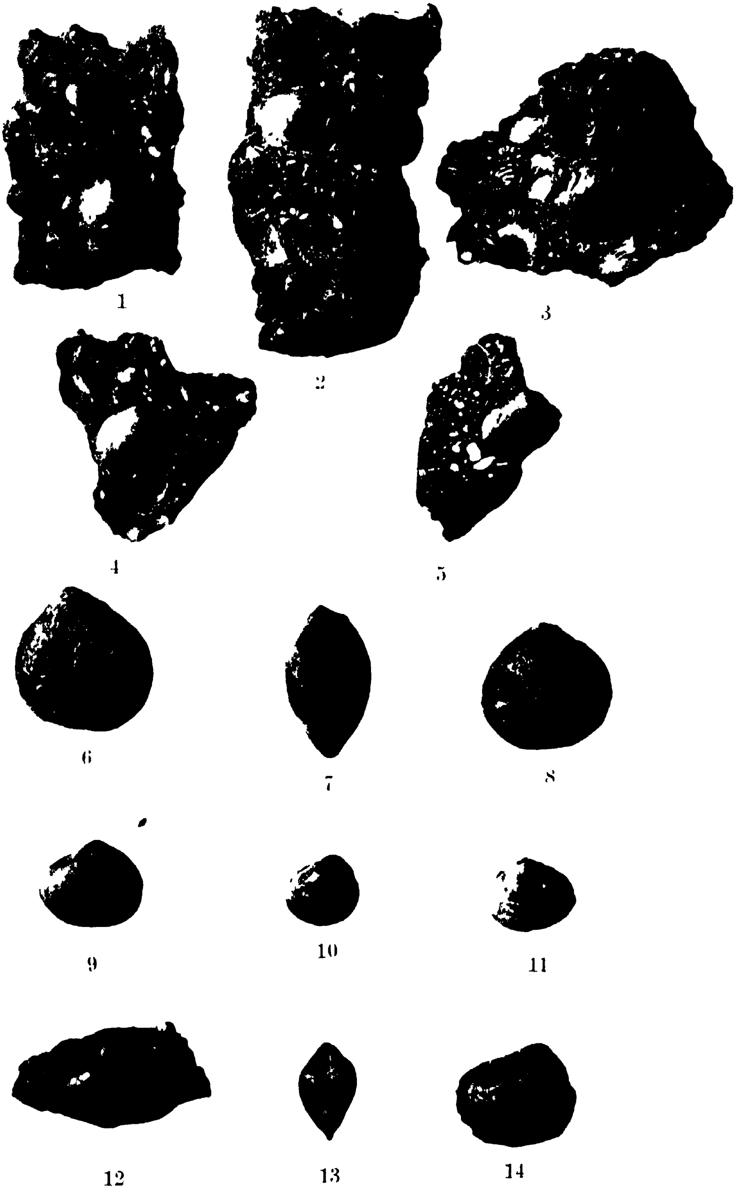
Fig. 11. Internal cast of left valve, showing flattened region posteriorly; A.M., Reg. No. F.23802. $\frac{3}{5}$ natural size.

Astartila parkesi sp. nov.

Fig. 12. Lateral view of right valve, showing heavy ornamentation; A.M., Reg. No. F.21022.

Fig. 13. A specimen of complete valves, seen in profile holotype; A.M., Reg. No. F.22016.

Fig. 14. Lateral view of a right valve; A.M., Reg. No. F.21031.



G. C. Clutton, photo.

EXPLANATION OF PLATE XXVIII.

Unless otherwise mentioned illustrations are $\frac{2}{3}$ natural size.

***Astartila cyprina* Dana.**

Fig. 1. A lateral view of an internal cast of a right valve, showing large anterior adductor muscle scar; A.M., Reg. No. L.641.*

Fig. 2. An internal cast of complete valves, seen in profile; A.M., Reg. No. L.642.*

Fig. 3. A specimen with portions of outer shell removed; A.M., Reg. No. L.639. $\frac{3}{5}$ natural size.*

Fig. 4. Internal cast. A lateral view of left valve, showing muscle scar; A.M., Reg. No. F.7188.

Fig. 5. An internal cast of right valve, showing faint internal ornamentation; A.M., Reg. No. F.21003.

***Astartila compressa* sp. nov.**

Fig. 6. A slightly distorted specimen of a left valve, showing angle of beak; A.M., Reg. No. F.20927.

Fig. 7. Left valve, showing ornamentation. The beak in this specimen is not recurved; A.M., Reg. No. 20935.

Fig. 8. Lateral view of a left valve, with recurved beak; A.M., Reg. No. F.20925.

Fig. 9. Lateral view of a right valve, showing external ornamentation; A.M., Reg. No. F.20936. $\frac{3}{5}$ natural size.

Fig. 10. A right valve with recurved beak; A.M., Reg. No. F.20910. $\frac{3}{5}$ natural size.

Fig. 11. A lateral view of a left valve, showing ornamentation, holotype; A.M., Reg. No. F.20907.

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* See footnote to explanation of Plate xxv.


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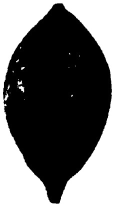
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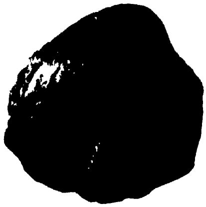
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G. C Clutton, photo.

EXPLANATION OF PLATE XXIX.

All illustrations are natural size.

Astartila subcarinata sp. nov.

Fig. 1. A lateral view of a left valve, showing portions of ornamentation, and almost vertical adductor muscle scar, holotype; A.M., Reg. No. F.21098.

Fig. 2. Complete valves, seen in profile; A.M., Reg. No. F.21095.

Fig. 3. Lateral view of a right valve, showing flattened posterior region; A.M., Reg. No. F.23803.

Astartila centralis sp. nov.

Fig. 4. Lateral view of a right valve, showing external ornamentation; A.M., Reg. No. F.21120.

Fig. 5. An internal cast of a left valve, showing excavate anterior muscle scar; A.M., Reg. No. F.1133.

Fig. 6. Lateral view of an internal cast, showing excavate anterior and posterior adductor muscle scars; A.M., Reg. No. F.21140.

Fig. 7. Lateral view of a right valve, holotype; A.M., Reg. No. F.1133*a*.

Astartila pusilla (McCoy).

Fig. 8. Internal cast of complete valves seen in profile showing the extreme width between beaks; A.M., Reg. No. F.3104.

Fig. 9. Complete shell. A plaster cast of McCoy's type; A.M., Reg. No. L.1424.

Fig. 10. An internal cast of a right valve. Plaster cast of McCoy's type; A.M., Reg. No. L.1425.

Fig. 11. Lateral view of an internal cast of the left valve; A.M., Reg. No. F.22019.

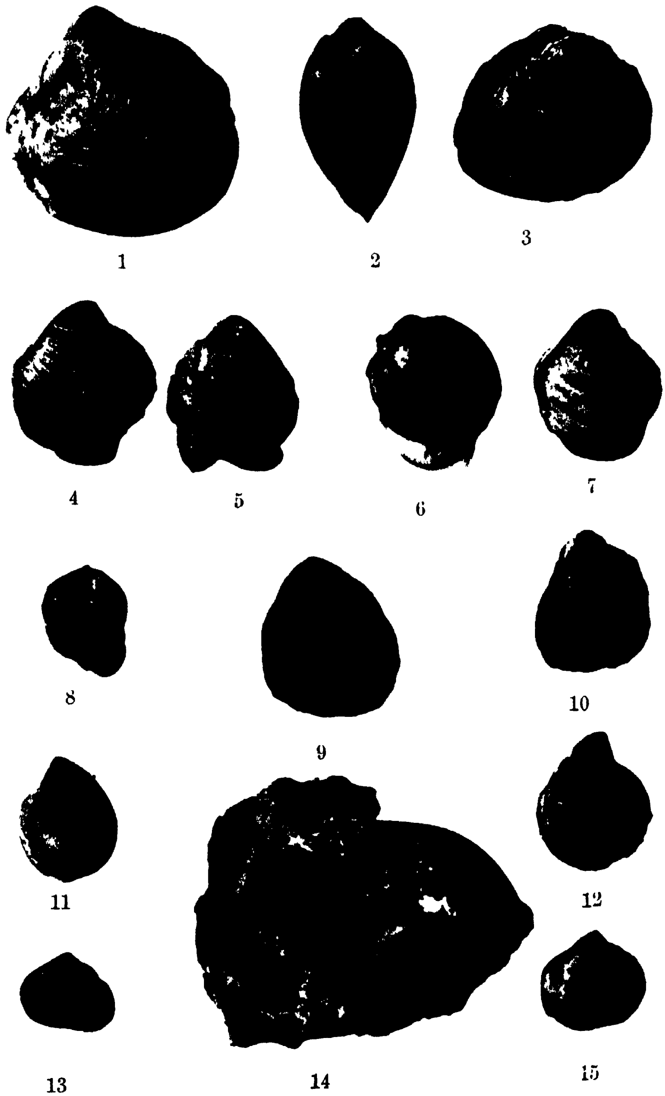
Fig. 12. Internal cast of a right valve. Lateral view; A.M., Reg. No. F.22018.

Astartila subgemma sp. nov.

Fig. 13. Internal cast of right valve, holotype, lateral view; A.M., Reg. No. F.23804.

Fig. 14. Internal cast of a left valve, showing oval anterior adductor muscle impression; A.M., Reg. No. F.21190.

Fig. 15. Lateral view of an internal cast of a right valve, showing posterior and anterior adductor muscle scars; A.M., Reg. No. 23805.



G. C. Clutton, photo.

STUDIES IN ICHTHYOLOGY.

No. 3.[1]

By

Gilbert P. Whitley,

Ichthyologist, Australian Museum, Sydney.

(Plates xxx-xxxiv and Figures 1-5.)

Family LAMNIDÆ.

Isurus mako, *sp. nov.*

1926 *Isurus glaucus* Phillipps, Trans. N. Zeal. Inst. (n.s.) lvi, 1926, p. 530, pl. lxxxvii. New Zealand. Not *Oxyrhina glauca* Müller and Henle, Plagiost. ii, 1839, p. 69, pl. xxix, from Java.

Mr. Zane Grey has recently written about the large game fishes of New Zealand in Natural History, xxviii, 1, 1928, p. 47 *et seq.*, and appears to have introduced two new names: *Seriola dorsalis* for the New Zealand Kingfish or Haku which has been generally identified with *S. lalandii* Cuv. and Val. and *Marlina* gen. nov. for the Striped Marlin Swordfish (*Makaira mitsukurii zelandica* Jordan and Evermann[2]), genotype by monotypy. These names he probably derived from the manuscripts of some American ichthyologist. Grey also refers to the New Zealand Mako shark as *Isurus sp.* but this might as well have been given a new name also as the New Zealand form hitherto called *I. glaucus* is evidently distinct from the typical Javanese species described by Müller and Henle. The excellent account given by Phillipps (*loc. cit.*) emphasizes the differences between the New Zealand Mako Shark and the true *Isurus glaucus* (M. & H.) and shows that the former requires a new name. *Isurus mako,* nom. nov., is therefore proposed for the specimen figured by Phillipps, to whom the credit is due for suggesting that the Neozelanic species might be new to science.

Family SCYLLIORHINIDÆ.

Genus Pristiurus *Bonaparte* 1834.

1810 *Galeus* Rafinesque, Caratt. Nuovi Generi Spec. Sicilia, Apr. 1, 1810, p. 13. Part referring to *G. melastomus* Raf. only (*fide* Jordan, Gen. Fish, i, 1917, p. 78); *Galeus* Raf. s. str. has as tautotype *Squalus galeus* Linn. 1758, which is not congeneric.

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[1] For No. 2, see "Records," xvi, No. 4, 1928, p. 211.

[2] Jordan and Evermann.—Occas. Pap. Calif. Acad. Sci., xii, 1926, p. 65, pl. xix, fig. 2. Bay of Islands, New Zealand.

1816 *Scylliorhinus* Blainville, Bull. Soc. Philom., 1816, p. 121—in part (*fide* Garman, Mem. Mus. Comp. Zool. Harvard, xxxvi, Sept., 1913, p. 91).

1821 ? *Prionurus* Otto, Conspect. anim. 1821, p. 5 (not seen). Preocc. by *Prionurus* Lacépède 1804.

1832 *Pristiurus* Bonaparte, Distr. Meth. Verh. [Saggio distr. metod. Anim. Vert.]. 1832, p. 63. *Nomen nudum* (*fide* C. D. Sherborn, *in lit.*).

1834 *Pristiurus* Bonaparte, Icon. Faun. Ital. (7), 1834 (not 1833 as stated by Agassiz), descr. of *Scyllium melanostomum* (*fide* C. D. Sherborn, *in lit.*). .

1837 *Pristiurus* Müller and Henle, Arch. Naturg. (Wiegmann), 3rd year, pt. i, 1837, p. 396; and Berichte Verh. K. Pr. Akad. Wiss. Berlin, July, 1837 (? publ. 1838), p. 113. Not *Pristurus* Rüppell, Neue Wirbelth. Amphib. 1835, p. 16, a genus of lizards.

1838 *Pristiurus* Müller and Henle, Mag. Nat. Hist. (Charlesw.), ii, Jan., 1838, p. 34.

1838 *Pristiurus* Smith, Proc. Zool. Soc. (Lond.), v (1837), Feb. 13, 1838, p. 86. Haplotype, *Scyllium melanostomum* Bonaparte (= *Galeus melastomus* Raf.).

1838 *Pristidurus* Bonaparte, Mem. Soc. Neuchatel ii, 1838, Selachorum tabula analytica, p. 11 (*fide* Dumeril, Hist. Nat. Poiss. i, 1, 1865, p. 324; date from Sherborn).

1838 *Pristiurus* Müller and Henle, Syst. beschr. Plagiostomen i, 1838, p. 15.

1839 *Pristiurus* Swainson, Nat. Hist. Classif. Fish. Amphib. Rept. ii, July, 1839, pp. 191 and 317.

1846 *Prionurus* Bonaparte, Catalog. Metod. Pesci Europei, 1846, p. 19. *Ex* Otto, 1821. Name only, substituted by *Pristiurus*, evidently based on *Squalus prionurus* Otto, 1821, which is a synonym of *Pristiurus melanostomus* Bonaparte; not *Prionurus* Lacépède 1804, another genus of fishes.

1851 *Pristidurus* Gray, List. Spec. Fish. Brit. Mus. i, Chrondropt. 1851, p. 32.

1865 *Pristiurus* Dumeril, Hist. Nat. Poiss. i, 1, 1865, p. 324.

1866 *Pristiurus* Bocage and Capello, Peixes Plagiost. i, 1866, p. 11. One species, *P. artedi* (Risso) which is a synonym of *P. melastomus* (Rafinesque).

1870 *Pristiurus* Günther, Cat. Fish. Brit. Mus. viii, 1870, p. 406.

1895 *Pristiurus* Goode and Bean, Oceanic Ichthyology, June, 1895, p. 20.

1908 *Pristiurus* Regan, Ann. Mag. Nat. Hist. (8), i, June 1, 1908, p. 463 (key to spp.).

1908 *Galeus* Fowler, Proc. Acad. Nat. Sci. Philad. lx, 1, June 9, 1908, p. 53. Not *Galeus* Rafinesque, s. str. *G. melastomus* Raf. designated as type; but *Squalus galeus* Linn., as tautotype, overrules this selection.

1910 *Pristurus* Parker and Haswell, Text-book Zool. ii, 1910, p. 183.

1912 *Pristiurus* Engelhardt, Zool. Anzeiger xxxix, 1912, p. 644.

1913 *Pristiurus* Engelhardt, Abh. Bayer K. Akad. Wiss. iv, Suppl.-Bd. 3, 1913, p. 98.

1913 *Pristiurus* Garman, Mem. Mus. Comp. Zool. Harvard xxxvi, Sept., 1913, pp. 68 and 91.

1919 *Pristidurus* Jordan, Gen. Fish. ii, 1919, p. 194. "Orthotype," *Galeus melastomus*.

1919 *Pristiurus* Jordan, Gen. Fish. ii, 1919, p. 208.

1920 *Pristiurus* Jordan, Gen. Fish. iv, 1920, p. 573. *Ex* McCulloch MS.

1922 *Pristiurus* Sæmundsson, Vidensk. Medd. Dansk. naturh. Foren. lxxiv, May, 1922, p. 169.

1923 *Pristiurus* and *Pristidurus* Jordan, Classif. Fish. 1923, p. 98.

1928 *Pristiurus* Whitley, Rec. Austr. Mus. xvi, 4, 1928, p. 238.

In reply to an enquiry, Mr. C. Davies Sherborn of the British Museum, kindly supplied me with 1832 and 1834 references to *Pristiurus* Bonaparte which show that this name cannot be suspected of being preoccupied by *Pristurus* Rüppell 1835, a genus of lizards. Müller and Henle cited the name in four publications which appeared at short intervals in 1837 and 1838. In 1838, Bonaparte used the variant *Pristidurus,* and in 1846 placed the name "*Prionurus* Ott." in brackets after *Pristiurus* Bp. Evidently he meant to imply that *Pristiurus* might be regarded as a substitute name for *Prionurus* Otto 1821 (type *Squalus prionurus* Otto), which is preoccupied by *Prionurus* Lacépède 1804. I have not seen Otto's work, nor have I been able to trace another reference to his genus *Prionurus*.

The type of *Pristiurus* is called by most authors *P. melanostomus,* but since that species was apparently not described by Bonaparte[3] until 1834, it seems more correct to call it *P. melastomus* (Rafinesque), which was originally included in the genus *Galeus.*[4] Other synonyms appear to be *Scyllium artedi* Risso[5] and *Squalus prionurus* Otto.[6]

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[3] Bonaparte—Icon. Faun. Ital. fasc. 7, 1834, p. 15. Not seen.

[4] Rafinesque—Caratt. Nuovi Generi Spec. Sicilia, Apr. 1, 1910, p. 13 (*fide* Jordan, Gen. Fish. i, 1917, p. 78)

[5] Risso.—Journ de Physique, xci, Oct., 1820, p. 241 (*fide* Sherborn, Ind. Anim.); and Hist. Nat. Eur. Merid. iii, 1826, p 117, pl. iii, fig. 5

[6] Otto.—Conspect. Anim. 1821, p. 5 (*fide* Müller and Henle, Plagiostomen).

An Australian relative is the deep-water *Figaro boardmani* which is sometimes trawled in the southern waters of New South Wales.[7]

Family ATHERINIDÆ.

ATHERINA UISILA *Jordan and Seale.*

(Fig. 1.)

1825 ? *Atherina vaigiensis* Quoy and Gaimard, Voy. Uranie Physic., Zool. 1825, p. 335. Waigiou.

1898 *Atherina lacunosa* Waite, Sci. Rept. Fishes,[8] in Farnell, Rept. Trawling Oper. "Thetis," about June, 1898, p. 60 (Lord Howe Island). Not *A. lacunosa* Bloch and Schneider 1801. Waite's specimens in Austr. Mus. examined.

1904 *Atherina lacunosa* Waite, Rec. Austr. Mus. v, 3, March, 1904, p. 197.

1906 *Atherina uisila* Jordan and Seale, Bull. U.S. Bur. Fish. xxv, Dec. 15, 1906, p. 216, fig. 23. Apia, Samoa. Type in U.S. Nat. Mus.; 2 paratypes in Austr. Mus.

1919 *Atherina uisila* Jordan and Hubbs, Stud. Ichth., Monogr. Silversides (Stanford Univ. Publ.), 1919, p. 42.

D.viii/i/10; A.i/13; P.16; V.i/5; C. 17. Sc. 43.

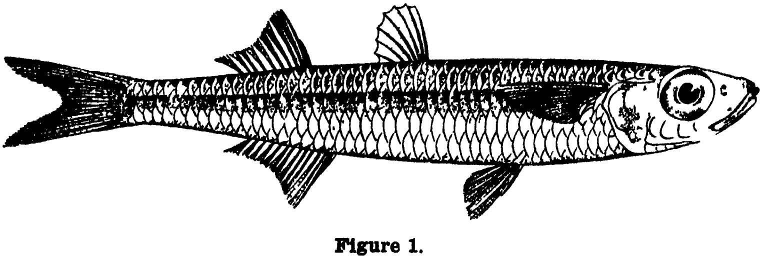

Figure 1.

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[7] Whitley.—Rec. Austr. Mus. xvi, 4, 1928, p. 238, pl. xviii, fig. 3.

[8] A preliminary account of the fishes obtained by the "Thetis" was written by Edgar R. Waite in Farnell's "Report upon Trawling Operations off the Coast of New South Wales, between the Manning River and Jervis Bay, carried on by H.M.C.S. 'Thetis,' under the Direction of Frank Farnell, Esq., M.P." This was issued in 8vo in a pink cover in about June, 1898, and contains important notes on New South Wales and Lord Howe Island fishes. Two new species were described therein: *Histiopterus farnelli*, p. 33, pl. iv; and *Chimæra ogilbyi*, p. 56, pl. xi. An edition dated 7th July, 1898, was issued in a blue cover, 8½ × 13 inches, and noted in Abstr. Proc. Linn. Soc. N. S. Wales, 31st Aug., 1898. Thus the smaller sized edition, which is registered 15th July, 1898, in the Australian Museum library, was evidently published first and should be quoted in ichthyological literature. The main report on the "Thetis" fishes was not issued until Dec. 23, 1899, in Austr. Mus. Mem. iv, part 1.

In passing, I may also record that Waite's "The Fishes of South Australia" (Handbk. Flor. Faun. S. Austr.) was published on May 22, 1923. A new name, *Spheroides lacrimosus*, was proposed on page 226.

This species has been recorded from Lord Howe Island as *Atherina lacunosa* Bloch and Schneider,[9] which has fewer scales. Re-examination of the Australian Museum series shows that the Lord Howe Island form is referable to *A. uisila* Jordan and Seale as it not only enters the section *Atherina* in Jordan and Hubbs' key (*loc. cit.*, p. 14), but has the following characters: Sc. 43, 18 predorsals, anus midway between origins of ventral and anal fins, teeth on vomer, elevated mandibular rami, premaxillary processes slightly more than half length of eye. Two paratypes of *A. uisila* have been compared with the Lord Howe Island series, of which one specimen (No. I.6652) is illustrated here.

Range.—Samoa; Lord Howe Island and New Hebrides (specimens in Austr. Mus.).

Family LEPTOCEPHALIDÆ.

Genus LEPTOCEPHALUS *Scopoli* 1777.

1763 "*Leptocephalus*" Gronow, Zoophyl. i, 1763, p. 135. Non-binomial.

1764 "*Conger*" Houttuyn, Nat. Hist. vii, 1, 1764, p. 103 (*fide* Sherborn, Ind. Anim.). Non-binomial, *teste* T. Iredale; *et vide* Jordan, Gen. Fish. ii, 1919, p. 167.

1775 "*Conger*" Klein, Schauplatz. Natur. i, 1775, p. 22. Logotype, *Muræna conger* Linnæus (*fide* Jordan, *loc. cit., infra,* 1917). Non-binomial.

1776 "*Morris*" [Pennant], Brit. Zool. iii, 4, 8vo ed., 1776, p. 158, pl. xxv, fig. 67. 4to ed. not seen, *sed vide* Iredale, Proc. Malac. Soc. Lond. xv, Dec., 1922, pp. 80-83. Specimen collected by W. Morris near Holyhead and sent by Pennant to Gronow of Leyden who had named it *Leptocephalus*.

1777 *Leptocephalus* Scopoli, Int. Hist. Nat. 1777, p. 453. *Genus cœlebs. Ex* Gronow. Logotype, *L. morrisii* Gmelin = *L. tæniola* Meuschen, the larval form of *Muræna conger* Linnæus. Not *Leptocephalus* Basilewsky 1855, another genus of fishes.

1781 *Leptocephalus* Meuschen, Index Gronov. Zoophyl. pt. iii, 1781. Haplotype, *L. tæniola* Meuschen, based on "*Leptocephalus*" Gronow.

1789 *Leptocephalus* Gmelin, Syst. Nat. (Linn.) ed. xiii, i, 3 (before 20th Nov.), 1789, pp. 1130 and 1150. Haplotype, *L. morrisii* Gmelin.

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[9] Bloch and Schneider.—Syst. Ichth. 1801, p. 112, *ex* Forster MS. New Caledonia. *Idem* Forster, Descr. Anim. maris Australis (ed. Lichtenstein), 1844, p. 298. *Idem* Ogilby, Mem Qld. Mus. i, 1912, pp 37 and 40, pl xii, fig. 2 and text-fig. *a*.

1789 *Morris* Berkenhout, Synops. Nat. Hist. Gt. Brit. Ireland ed. 2, vol. i, 1789, p. 65. Haplotype, *Morris sp.* from Anglesea, "*Br. Zool.* iii, No. 67," = *Leptocephalus tæniola* Meuschen. *Idem, ibid.* ed. 3, vol. i, 1795, p. 65.

1816 "*Les Congres*" Cuvier, Règn. Anim. ed. 1, ii, "1817" = Dec., 1816, p. 231. Vernacular, not latinized by Schinz, 1822.

1817 *Conger* Oken, Isis, 1817, p. [1182*a*] (*fide* Sherborn). *Nomen nudum* regarded as = "Les Congres," Cuvier.

1826 *Conger* Risso, Hist. Nat. Eur. Merid. iii, 1826, p. 200. Logotype, by present designation and by virtual tautonomy, *Conger verus* Risso = *Muræna conger* Linnæus.

1832 *Conger* Voigt, Das Thierreich (Cuvier) ii, 1832, p. 456. *Ex* Cuvier, *vernac.*

1840 "The Morris (*Leptocephalus*)" Gray, Synops. Cont. Brit. Mus., ed. 42, second issue, p. 52.

1845 *Congrus* Richardson, Zool. Sulphur (Fish), 1845, p. 105. Variant of *Conger*.

1848 *Congrus* Richardson, Voy. Erebus and Terror (Fish, 1848), p. 107.

1917 *Leptocephalus* Jordan, Gen. Fish, i, 1917, p. 22.

1917 *Conger* Jordan, Gen. Fish. i, 1917, pp. 22, 37 and 101.

1919 *Conger* Jordan, Gen. Fish. ii, 1919, p. 167.

1925 *Conger* Jordan and Hubbs, Mem. Carneg. Mus. x, 2, June 27, 1925, p. 193.

Status of the genus MORRIS *Berkenhaut.*

In the second edition (1789) of his Synopsis, Berkenhout intro duced a new generic name, *Morris*, on p. 65, as follows:—

"MORRIS. Head small. Body thin, compressed. Pectoral Fins o.

"1. . . . Anglesea. Eyes large. Teeth in both jaws, minute. Dorsal Fin very low, the whole length of the Back. Body $\frac{1}{10}$ of an inch thick. Whole Length 4 inches. Sides marked with oblique lines meeting in the lateral line. *Br. Zool.* iii, No. 67."

This diagnosis does not appear in the first edition (1769) of Berkenhout's "Synopsis," but is reprinted without alteration on p. 25 of the third edition (1795). The first and second editions are in the library of Mr. T. Iredale, to whom I am indebted for calling my attention to the name *Morris*; the third edition is in the Australian Museum. *Morris* Berkenhaut is a valid generic name, and

not, like the "Morris" of Pennant's "British Zoology," a vernacular designation. It has been overlooked by subsequent authors, and is missed from Jordan's "Genera of Fishes." As shown in the above synonymy, *Morris* is a direct synonym of *Leptocephalus* Scopoli; a later synonym being *Conger* Risso, with its variant *Congrus* Richardson.

Leptocephalus tæniola Meuschen 1781 is the first binomial specific name given to the larval form of the conger eel, and is prior to *Leptocephalus morrisii* Gmelin 1789, but both names are synonyms of *Muræna conger* Linnæus 1758, which must now be known as *Leptocephalus conger*.

Family MURÆNIDÆ.

PSEUDECHIDNA BRUMMERI (*Bleeker*).

1858 9 *Muræna brummeri* Bleeker, Nat. Tijdschr. Ned. Ind. xvii, 1858-9, p. 137. Timor.

1865 *Strophidon polyodon* Bleeker, Ned. Tijdschr. Dierk. ii, 1865, p. 47. Amboina.

1865 *Strophidon brummeri* Bleeker, Atl. Ichth. iv, 1865, p. 109, pl. clxii, fig. 1.

1865 *Strophidon polyodon* Bleeker, *ibid.* p. 109, pl. clxiii, fig. 3.

1872 *Muræna tænioides* Günther, Proc. Zool. Soc. Lond. 1871 (May 2, 1872), p. 674. Savaii, Samoa.

1901 *Strophidon brummeri* Jordan and Snyder, Proc. U.S. Nat. Mus. xxiii, 1901, p. 885.

1906 *Gymnothorax tænioides* Jordan and Seale, Bull. U.S. Bur. Fish. xxv, 1906, p. 199, also p. 203 as *Strophidon brummeri*.

1910 *Muræna brummeri* Günther, Journ. Mus. Godeff. vi, 17 (Fische Südsee ix), 1910, p. 420.

1913 *Gymnothorax megapterus* Weber, Siboga Exped., Fische, May, 1913, p. 57, pl. vii, fig. 1. Savu Id., East Indies.

1916 *Muræna* (*Strophidon*) *brummeri* Weber and Beaufort, Fish. Indo-Austr. Archip. iii, 1916, p. 359, fig. 179 (references).

1922 *Strophidon brummeri* Fowler and Bean, Proc. U.S. Nat. Mus. lxii, 2, 1922, p. 9.

1929 *Strophidon brummeri* Deraniyagala, Spolia Zeyl. xv, 1, 1929, p. 22, pl. ii, fig. p (dentition).

Mr. Melbourne Ward collected two specimens of this elongate eel at Murray Island, Torres Strait. Austr. Mus. Nos. IA.3723-4.

New record for Australia.

Family ALABETIDÆ.

ALABES PARVULUS (*McCulloch*).

(Plate xxxi, fig. 7.)

1909 *Cheilobranchus parvulus* McCulloch, Rec. Austr. Mus. vii, 4, Aug. 30, 1909, p. 316, fig. 18. Rockpools near Sydney. Types in Austr. Mus.

In preservatives, specimens of *Alabes* generally become opaque and lose their natural colours. The painting by Mr. A. R. McCulloch reproduced here is therefore of particular value as it depicts a living specimen caught in Coogee Baths, near Sydney, on 2nd August, 1920.

Family CONGROGADIDÆ.

CONGROGADUS SUBDUCENS (*Richardson*).

(Plate xxx, fig. 1.)

1843 *Machærium subducens* Richardson, Ann. Mag. Nat. Hist. xii, Sept. 1, 1843, p. 175, pl. vi. Port Essington, North Australia, Type in Brit. Mus. (Nat. Hist.).

1926 *Congrogadus subducens* Whitley, Austr. Zoologist iv, 1926, p. 236, fig. 1. Larva from Capricorn Group, Queensland.

Mr. McCulloch's painting represents a Port Darwin specimen, 10¼ inches long, collected by Messrs. J. Christie and — Godfrey in 1902 (Austr. Mus. No. I.5151).

Besides a series of specimens, 8½ to 13 inches in length, from Port Darwin, there are specimens in the Australian Museum from Murray Island, North-west Islet, Palm Islands, and Port Denison, Queensland.

Family ZEIDÆ.

Genus OREOSOMA *Cuvier* 1829.

1829 *Oreosoma* Cuvier, Regn. Anim. ed. 2, ii, April, 1829, p. 171. *Genus cœlebs.*

1829 *Oreosoma* Cuvier and Valenciennes, Hist. Nat. Poiss. iv, Nov., 1829, p. 515. Haplotype, *O. atlanticum* C. and V.; *ibid.*, p. 515, pl. xcix, as *O. coniferum.*

1839 *Oriosoma* (sic) Swainson, Nat. Hist. Classif. Fish. Amphib. Rept. ii, July, 1839, pp. 21, 169, and 208. Based on "O. coniferum Cuv. pl. 99."

1893 *Oreosoma* Vaillant, Comptes Rendus Acad. Sci. Paris cxvi, 1893, p. 598.

Vaillant gives important notes on the Atlantic species and discusses the affinities of this remarkable genus.

Oreosoma waitei, *nom. nov.*

1912 *Oreosoma atlanticum* Waite, Trans. Proc. N. Zeal. Inst. xliv, 1911 (publ. June 10, 1912), p. 197, pl. xi. Lyall Bay, near Wellington, N. Zealand. Not *O. atlanticum* C. and V. 1829.

1914 *Oreosoma atlanticum* McCulloch, Biol. Res. Endeavour ii, 3, 1914, p. 115.

1927 *Oreosoma atlanticum* Phillipps, N.Z. Mar. Dept. Fish. Bull. i, 1927, p. 25.

A new name is required for the New Zealand species called *Oreosoma atlanticum* by Waite, as it differs in several respects from the Atlantic species. These differences were noted by Waite, but he did not give a distinguishing name to the species; I accordingly propose *Oreosoma waitei,* nom. nov. for the specimen figured by Waite.

Oreosoma coniferum was an alternative name for the Atlantic species given on Cuvier and Valenciennes' plate, and copied by Voigt,[10] but it must be sunk as an absolute synonym of *O. atlanticum.*

Family EPINEPHELIDÆ.

Maccullochella, *gen. nov.*

When reading some proof-sheets of Mr. C. D. Sherborn's "Index Animalium," now in course of publication, I noticed that the name *Oligorus* had been used for a genus of Coleoptera by Dejean[11] many years before Günther[12] applied it to the fish commonly known in Australia as the Murray Cod. Günther's name being therefore rendered invalid, as Scudder also noted, *Homodemus* De Vis[13] next claims attention as it is the only synonym of *Oligorus* known to me. This name, however, is preoccupied by *Homodemus* Fieber[14] and cannot be employed. The Murray Cod was first described by Cuvier and Valenciennes[15] as *Grystes macquariensis,* the type having come from the Macquarie River, New South Wales. The genotype of *Grystes* is *G. salmoides* C. and V., an American species

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[10] Voigt.—Das Thierreich (Cuvier) ii, 1832, p. 237.

[11] Dejean.—Catal. Coleopt., ed. 2, iii, *ante* Oct., 1834, p. 206. *Teste* C. D. Sherborn.

[12] Günther.—Cat. Fish. Brit. Mus. i, 1859, p. 251. Logotype, *Grystes macquariensis.*

[13] De Vis.—Proc. Linn. Soc. N. S. Wales ix, 2, Aug. 19, 1884, p. 395. Haplotype, *H. cavifrons.*

[14] Fieber.—Wiener Entomol. Monatschr. ii, 11, Nov., 1858, pp. 343 and 388, genus 22. *Nomen novum pro Hadrodemus* Fieber, *ibid.* ii, 10, Oct., 1858, p. 305, genus 22 (*non Hadrodema*, p. 311, genus 44). A genus of Hemiptera.

[15] Cuvier and Valenciennes, Hist. Nat. Poiss. iii, April, 1829, p. 58.

not congeneric with the Australian form, as Günther recognised. *Gristes* Mitchell,[16] emended to *Grystes* by Agassiz,[17] applies to the Murray Cod, as does also *Gryptes* Lesson,[18] a *nomen nudum,* but these names are mere variants of *Grystes* Cuvier and Valenciennes.[19]

The Murray Cod therefore requires a new generic name, so I propose *Maccullochella* for it in honour of the late Allan R. McCulloch. The genotype, *Grystes macquariensis,* will now be known as *Maccullochella macquariensis* (Cuvier and Valenciennes).

Family HYPOPLECTRODIDÆ.

ELLERKELDIA MACCULLOCHI, *sp. nov.*

(Plate xxx, fig. 3.)

1859 *Plectropoma semicinctum* Günther, Cat. Fish. Brit. Mus. i, 1859, p. 160 [Eastern] Australian specimen only. Not *P. semicinctum* Cuv. and Val. 1833.

1866 *Plectropoma semicinctum* Steindachner, Sitzb. Akad. Wiss. Wien. liii, 1866, p. 425.

1879 *Plectropoma semicinctum* Schmeltz, Mus. Godef. Cat. vii, 1879, p. 37.

1891 *Gilbertia semicincta* Jordan and Eigenmann, Bull. U.S. Fish. Comm. viii, 1888 (publ. Mar. 25, 1891), p. 347. Australian refs. only.

1895 *Gilbertia semicincta* Boulenger, Cat. Perc. Fish. Brit. Mus., 1895, p. 307.

1899 *Hypoplectrodes semicinctus* Waite, Austr. Mus. Mem. iv, 1899, p. 76.

1911 *Hypoplectrodes semicincta* McCulloch, Zool. Res. Endeavour i, 1911, p. 50.

1920 *Gilbertia semicincta* Rendahl, Nat. Hist. Juan Fern. and Easter I., iii, 1920, pp. 50, 51 and 55. Australian refs. only.

1921 *Gilbertia semicincta* McCulloch, Austr. Zool. ii, 2, 1921, p. 46; Check-list, 1922, p. 46.

Br.7. D.x/21; A.iii/8; P.i/16; V.i/5; C.14. L.lat.46. L.tr.6/1/20.

Head (46 mm.) subequal to depth (45) 2·5 in length to hypural joint (115). Maxillary (21) 2·2, eye (9) 5·1, interorbital (5) 9·2, preorbital (7) 6·5 in head.

[16] Mitchell.—Three Exped. Int. Austr. i, 1838, p. 95.
[17] Agassiz.—Nomencl. Zool., Index Univ., 1846.
[18] Lesson.—Ann. Sci. Nat. vi, Nov., 1825, p. 253.
[19] Cuvier and Valenciennes.—Hist. Nat. Poiss. iii, April, 1829, p. 54.

Head scaly except on chin, preorbital, jaws, and a median area over the premaxillary processes. Interorbital very slightly convex. Two nostrils on each side, their openings circular with broad flaps. Preopercular margin rounded with strong serrations on the upper limb and three strong hook-like spines pointing forward from the angle and lower limb. Preorbital and opercular margins entire. Three flat spines on operculum, the median largest and centrally situated. Maxillary naked, reaching to below middle of eye, with a groove distinguishing the supplemental bone. Lower jaw longer than upper. Bands of small sharp teeth on jaws, vomer, and palatines, the inner ones depressible. Canines on each side of symphyses and one or two on each side of lower jaw. Tongue shaped like an arrowhead, toothless, and with a somewhat spatulate tip. Gill-rakers slender, spaced, 13 on lower limb of first gill arch.

Body compressed, upper profile more arched than lower. It is entirely covered by finely ctenoid scales which are largest on the upper portions of the sides and smallest on the breast; they extend on to all the fins except the ventrals. More than forty transverse rows of scales between operculum and hypural joint. Lateral line beginning below a toothed scale, arched to below first dorsal, after which it follows curve of back and extends along caudal peduncle to base of tail; a scale from the lateral line has a smooth round root with a pocket-like flap over its tube. Vent in advance of anal fin.

Dorsal originating over opecular flap and terminating well behind anal. Fourth spine longest, but not so long as most of the dorsal rays. Margins of first and second dorsal convex. Second anal spine longer and stronger than any dorsal spine. Margin of anal rounded, the anterior rays much thickened. Pectoral reaching almost to level of anal, its upper rays normal, but the lower rays are much branched and feather like, as are also the anterior ventral and lowest caudal rays. Ventral reaching more than half-way from its origin to that of anal. Caudal emarginate.

The colours of this species may be seen from the accompanying figure. There are usually seven cross-bars on the body which do not extend more than half-way down the sides except in very young specimens.

Described from the holotype of the species, a specimen 5½ inches long, collected at Maroubra, New South Wales, by Mr. J. R. Kinghorn in July, 1912. Austr. Mus. regd. No. I.12472. The specimen figured was caught in September, 1902, at Rose Bay, Port Jackson.

This species has been confused with *Plectropoma semicinctum* Cuvier and Valenciennes[20] by authors. That Chilean species has

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[20] Cuvier and Valenciennes.—Hist Nat Poiss ix, March, 1833, p 442, San Juan Fernandez.

been figured by Guichenot[21] and described by Jordan and Eigenmann[22] who made it the genotype of *Gilbertia*. As that name is preoccupied, the name *Ellerkeldia* proposed by me[23] for the allied *Plectropoma annulata* Günther is available for the present species.

Ellerkeldia maccullochi differs from *E. semicincta* in having a higher soft dorsal fin, transverse bars not extending to lower half of body, no dark marks on breast.

Specimens are in the Australian Museum from various localities in New South Wales, where the species apparently lives amongst rocks off shore. Günther[24] recorded this species or a close ally from Western Australia. There is also a form in New Zealand which has been named *Plectropoma huntii*.[25]

Family CICHLIDÆ.

Reganochromis, *gen. nov.*

Orthotype.—*Paratilapia calliura* Boulenger.

Leptochromis Regan,[26] proposed for this species, is preoccupied by *Leptochromis* Bleeker,[27] a genus allied to *Pseudochromis*. *Leptochromis* Regan (*non* Bleeker) is therefore re-named *Reganochromis*, with *R. calliurus* (Boulenger), the only species so far known, as genotype.

Family PSEUDOCHROMIDIDÆ.

Genus Leptochromis *Bleeker* 1876.

1876 *Leptochromis* Bleeker, Verh. Akad. Amsterdam xv, 1876, p. 21. Orthotype, *Pseudochromis cyanotænia* Bleeker (*fide* Jordan, Gen. Fish. iii, 1919, p. 382). Not *Leptochromis* Regan 1920, fam. Cichlidæ, = *Reganochromis* mihi. *Idem* Bleeker, Arch. Néerl. Sci. Nat. xi, 1876, pt. 2, p. 321 (*fide* Weber and Beaufort, Fish. Indo-Austr. Archip. i, 1911, p. 234).

1926 *Pseudochromis* subg. *Leptochromis* McCulloch, Biol. Res. Endeavour v, 4, 1926, p. 185.

Allied to *Pseudochromis* Rüppell, but with all the dorsal and anal rays branched.

Genotype.—*Pseudochromis cyanotænia* Bleeker.[28]

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[21] Guichenot.—Hist. Chile (Gay), Zool. ii, 1849, p. 153, Ictiol. pl. ii, fig. 1. For note on figure see Boulenger, Cat. Perc. Fish. Brit. Mus., 1895, p. 307.

[22] Jordan and Eigenmann.—Bull. U.S. Fish. Comm. viii, 1888 (1891), p. 347; Rendahl, Nat. Hist. J. Fern. and Easter I. iii, 1920, pp. 50, 51 and 55.

[23] Whitley.—Rec. Austr. Mus. xv, 5, 1927, p. 298.

[24] Günther.—Cat. Fish. Brit. Mus. i, 1859, p. 160. Swan River.

[25] Hector.—Trans. N. Zeal. Inst. vii, July, 1875, p. 240, pl. x, fig. 1. Chatham Is. See also Gill, Mem. Acad. Washington vi, 1893, p. 116; Hutton, Trans. N. Zeal. Inst. xxviii, June, 1896, p. 314; Waite, Rec. Canterbury Mus. i, 1, 1907, p. 19 and *ibid.* i, 3, 1911, p. 216.

[26] Regan.—Ann. Mag. Nat. Hist. (9), v, Jan. 1, 1920, pp. 36 and 46.

[27] Bleeker.—Verh. Akad. Amsterdam xv, 1876, p. 21 (*fide* Jordan, Gen. Fish.).

[28] Bleeker.—Nat. Tijdschr. Ned. Ind. xiii, 1857, p. 72. Boero, East Indies.

LEPTOCHROMIS TAPEINOSOMA WILSONI *subsp. nov.*

1853 ? *Pseudochromis tapeinosoma* Bleeker, Nat. Tijdschr. Ned Ind. iv, 1853, p. 115. Amboina, East Indies. *Idem*, Bleeker, Atlas Ichth. ix, 1877, pl. cccxc, f. 1.

1926 ? *Pseudochromis* (*Leptochromis*) *tapeinosoma* McCulloch, Biol. Res. Endeavour v, 4, 1926, p. 192, pl. li.

D.iii/26; A.ii/15 (last ray divided in each fin). L.lat. 31-33 plus 8-9; l.tr. 2/1/14-15. 39-42 transverse rows of scales between operculum and hypural joint.

Dorsal and anal spines pungent. Anterior and posterior portions of the lateral line separated by four rows of scales.

General colour, in spirit, light brownish becoming darker on top of head; all the fins lighter in tone. A few very indistinct transverse bars on the body and a dusky patch on operculum. Upper and lower borders of caudal lighter than its median portion; some obscure dusky bars on dorsal membranes.

Maximum length 53 mm. Standard length of holotype, 50; of paratype, 49.

Described from the holotype and paratype of the subspecies, registered Nos. IA.3873 and 3874 respectively, in the Australian Museum, Sydney.

Locality.—Port Darwin, North Australia.

Named after Mr. Leonard Wilson, of Darwin, who has made several collections of animals for the Australian Museum.

Affinities.—McCulloch (*loc. cit.*, p. 186) has given a key to the Australian species of *Pseudochromis* and *Leptochromis*. The new subspecies enters the section of the latter with the operculum unarmed. It differs from *L. tapeinosoma tapeinosoma* noticeably in having more dorsal rays, and appears to attain a larger size. *L. cyanotænia* Bleeker and *L. melanotænia* Bleeker have only about 22 dorsal rays and, as may be seen from the Atlas Ichthyologique, are differently coloured.

Family LEIOGNATHIDÆ.

LEIOGNATHUS DEVISI, *nom. nov.*

(Fig. 2.)

1884 *Equula argentea* De Vis, Proc. Linn. Soc. N. S. Wales ix, 3, Nov. 29, 1884, p. 542. Cape York, Queensland. Type in Queensland Museum examined. *Idem* Saville-Kent, Gt. Barrier Reef, 1893, p. 369. Name anticipated by *Leiognathus argenteus* Lacépède, Hist. Nat. Poiss. iv, 1802, p. 448.

1925 *Leiognathus argenteus* McCulloch and Whitley, Mem. Qld. Mus. viii, 1925, p. 145. *Ex* De Vis, *non*. Lacépède.

D.i(procumbent),viii/15; A.i,iii/14; P.19; V.i/5; C.16. L.lat. c.60.

Head (15 mm.) 2·8 in length to hypural joint (43); depth (21) 2·04 in same. Eye (4·5) 3·3, interorbital (5) 3·0, snout (5) 3·0, second dorsal spine (9) 1·6, and second anal spine (8) 1·9 in the head.

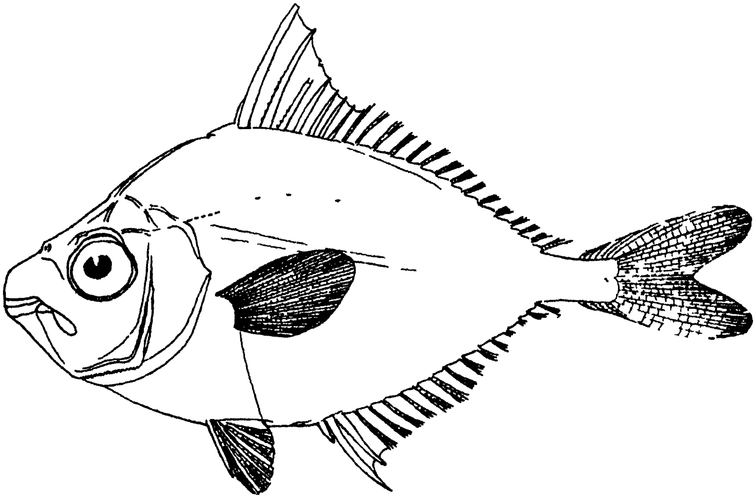


Figure 2

Head longer than high and broadest just behind the eyes, its upper profile not so steep as the lower. Eye large, outline of orbital margin somewhat pyriform. Two nostrils situated on a prominence before each eye, the posterior nostril the larger. Snout blunt, its distance from the eye equal to interorbital width. A median ridge and two lateral ones are situated on the interorbital and converge into a spine like nuchal ridge which extends almost to the pro cumbent dorsal spine. Supraorbital ridge smooth. Opercles entire excepting the lower preopercular limb which is finely serrated. Preopercular stay prominent. Mouth subhorizontal; maxillary extending to below posterior edge of eye. Minute pointed teeth in each jaw.

Body deep, much compressed; dorsal profile slightly more convex than the ventral, which is more evenly rounded. The type specimen is denuded of scales. Lateral line extending from shoulder to tail, subhorizontal anteriorly and gently curved posteriorly to

below the soft dorsal when it runs along the side of the caudal peduncle. A silver line extends from the base of the last pectoral ray to near the vent.

Dorsal with a procumbent spine followed by the main spinous fin. The first spine is small and originates in advance of the vertical of the origin of the anal. Second dorsal spine curved and compressed, slightly longer than the second anal spine and more than half length of head. Remaining dorsal spines decreasing in height posteriorly; the third and fourth are serrated anteriorly as is also the third anal spine. Base of soft dorsal subequal to that of anal. Pectorals rounded, longer than second dorsal spine. Ventrals small, reaching half-way along the procumbent anal spine when adpressed. Caudal broad, distinctly forked: the lobes are about equal to the head without snout.

De Vis gave the colour as "Uniform silvery, or with the back tinged with pink." The specimen here described now shows no coloration but there are punctations widely spaced on the opercles and lower half of the sides of the thorax and body.

Described and figured from the type of *Equula argentea* De Vis, a specimen 43 mm. long from snout to hypural joint. De Vis' original description was based on two specimens but as this is the only one now preserved in the Queensland Museum, it may be designated the holotype. Queensland Museum regd. No. I.13/1699.

Locality.—Cape York, North Queensland; collected by Kendall Broadbent.

Family CALLIONYMIDÆ.

CALLIONYMUS LIMICEPS *Ogilby.*

(Figs. 3 4.)

1908 *Callionymus limiceps* Ogilby, Ann Qld. Mus. ix, Oct. 14, 1908, pp. 4 and 35. Moreton Bay, S. Queensland. Types in Queensland Museum, Brisbane.

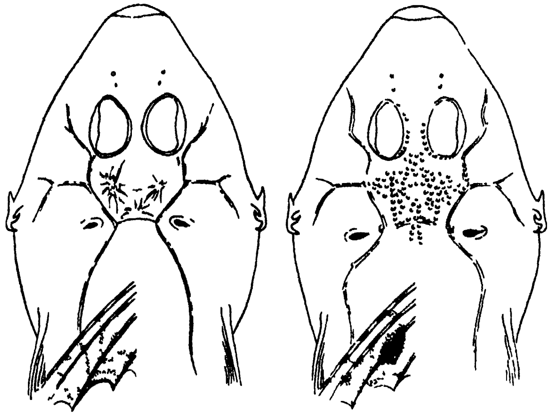
1923 *Callionymus limiceps* McCulloch, Rec. Austr. Mus. xiv, 1923, pp. 7 and 9, pl. iii, fig. 1, *a-d*.

1926 *Callionymus limiceps typica* McCulloch, Biol. Res. Endeavour v, 4, 1926, pp. 195 and 203.

1926 *Callionymus limiceps sublævis* McCulloch, *loc. cit.*, pp. 195 and 204. Off Hummocky Island, Queensland. Type on deposit in Austr. Mus.

A specimen was caught by Captain L. Comtesse in the Dredge "Triton" over Sow and Pigs Reef, Port Jackson, 12th April, 1929, when Messrs. F. A. McNeill and Melbourne Ward secured it for the

Australian Museum (No. IA.3843). This Queensland species has not hitherto been recorded from New South Wales and seems to support Iredale's contention[29] that a tropical faunula is still in existence in Port Jackson beyond the littoral zone.



Figures 3 and 4.

The opportunity is taken of presenting herewith figures of the armature of the head in *Callionymus limiceps* (fig. 4) and the type of McCulloch's variety *sublævis* (fig. 3) from off Hummocky Island, Queensland (No. E.6715).

Family GERRIDÆ.

GERRES ARGYREUS (*Bloch and Schneider*).

(Fig. 5.)

1801 *Cichla argyrea* Bloch and Schneider, Syst. Ichth., 1801, p. 344. *Ex Sciæna argyrea* Forster MS. Tanna, New Hebrides.

1824 ? *Gerres waigiensis* Quoy and Gaimard, Voy. Uranie and Physic., 1824, p. 292. Waigiou and Rawak.

1829 *Gerres argyreus* Cuvier, Règn. Anim. ed. 2, ii, April, 1829, p. 188, footnote. *Id.*, Cuvier and Valenciennes, Hist. Nat. Poiss. vi, Sept., 1830, p. 478.

1844 *Sciæna argyrea* Forster, Descr. Anim. maris Austr. (*ed.* Lichtenstein), 1844, p. 291. Tanna; Aug. 15, 1774.

1862 *Gerres argyreus* Günther, Cat. Fish. Brit. Mus. iv, 1862, p. 263.

[29] Iredale.—Austr. Zoologist, v, 4, 1929, p. 337.

1913 *?Xystœma darnleyense* Ogilby, Mem. Qld. Mus. ii, Dec. 10, 1913, p. 86, pl. xxiii. Darnley Island, Torres Strait, Queensland. Holotype in Qld. Museum.

The accompanying figure has been prepared from a virtual topotype. This specimen (Austr. Mus. No. I.12014) is 163 mm. long from snout to end of middle caudal rays and was collected in the New Hebrides about eighteen years ago by officers of H.M.S. "Pegasus." Messrs. Troughton and Livingstone collected the species at Naunaha Island and Peu, Vanikoro, Santa Cruz Group. Their specimens agree with the topotypical ones of this well-known species in having D.ix/10; A.iii/7. Eye longer than snout, equal to second anal spine. Height one-third of total length, and more than length of head. Pectoral not quite reaching anal origin.

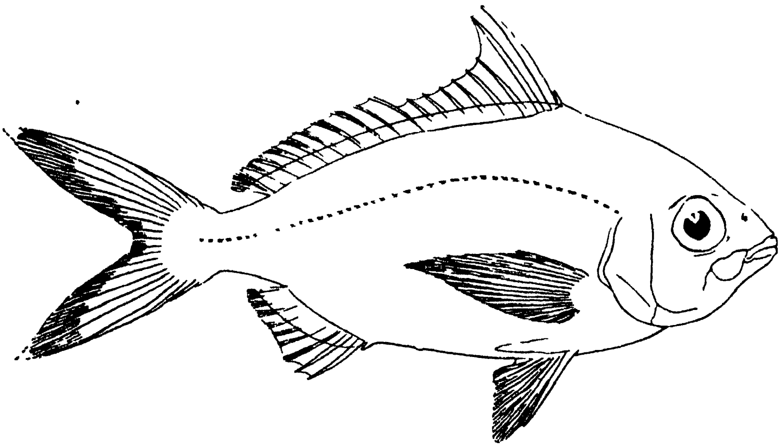


Figure 5

Gerres waigiensis and *Xystæma darnleyense* are so closely allied to *Gerres argyreus* that I am inclined to regard them as synonyms of it.

Family SYNGNATHIDÆ.

CORYTHOICHTHYS SAUVAGEI, *nom. nov.*

1879 *Syngnathus modestus* Sauvage, Bull. Soc. Philom. Paris (7) iii, 1879, p. 209 (6 of reprint). Noble Island, Australia. Type in Paris Museum. Name preoccupied by *S. modestus* Günther 1870.

1909 *Syngnathus modestus* Duncker, Faun. S.W. Austr. ii, 15, Pisces i, 1909, p. 246.

1915 *Syngnathus modestus* Duncker, Jahrb. Hamburg Wiss. Anst. xxxii, 1915, p. 86.

1925 *Corythoichthys pœcilolæmus* McCulloch and Whitley, Mem. Qld. Mus. viii, 2, 1925, p. 137. Based on Sauvage 1879. Not *Syngnathus pœcilolæmus* Peters 1869.

Syngnathus modestus Sauvage is preoccupied by *S. modestus* Günther.[30] Duncker and later authors have regarded Sauvage's species as being related to or synonymous with *Syngnathus pœcilolæmus* Peters[31] from Adelaide. Sauvage's fin-formulæ disagree with those of South Australian specimens,[32] however, and, as I am unable to reconcile the Queensland species with any of the forms known to me, it becomes necessary to rename it. I therefore propose *Corythoichthys sauvagei* for *Syngnathus modestus* Sauvage, preocc. The type-locality is Noble Island which lies near the Howick Group, Great Barrier Reef, Queensland.

The following is a copy of the original description:

"D.28; A.5; C.6; P.15. Dorsale partant de l'avant-dernier anneau du tronc et se prolongeant sur cinq anneaux de la queue. Longueur de la tête contenue près de sept fois dans la longueur totale du corps, bien plus longue que la dorsale; museau allongé et pointu; région interorbitaire bien plus longue que la région postorbitaire; 47 anneaux à la queue, 18 au tronc. Caudale courte, un peu plus longue seulement que le diamètre de l'orbite. Couleur brune uniforme. Longueur totale 0,100; longueur de la queue 0,060; longueur de la tête 0,015; longueur du museau 0,008; de la région postoculaire 0,006. Un mâle venant de Noble Island, Australie, par M. de Castelnau."

Family ACINACEIDÆ.

1905 *Lemnisomidæ* Fowler, Proc. Acad. Nat. Sci. Philad. 1904 (1905), p. 767.

1911 *Ruvettidæ* Snyder, Proc. U.S. Nat. Mus. xl, May, 1911, p. 527.

1923 *Gempylidæ* Jordan, Classif. Fish., 1923, p. 180, and most modern authors.

The earliest described genus in this family appears to be *Acinacea* Bory de St. Vincent,[33] so the family name is changed accordingly.

Genus LUCOSCOMBRUS *Van der Hoeven* 1858.

I have not seen Van der Hoeven's "Handbuch der Dierkunde," published in Amsterdam in 1850, but recently secured a copy of

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[30] Günther.—Cat. Fish. Brit. Mus. viii, 1870, p. 166. Hab.?
[31] Peters.—Monatsb. Akad. Wiss. Berlin, 1868 (1869), p. 458.
[32] Waite and Hale.—Rec. S. Austr. Mus. i, 4, 1921, p. 295, fig. 39.
[33] Bory de St. Vincent.—Voy. Iles Afriq. i, 1804, p. 93; *fide* Sherborn, Index Anim., and Jordan, Gen. Fish. ii, 1919, p. 170. Name emended to *Acinaces* by Agassiz, Nomencl. Zool., 1846, Index Univ.

Clark's English translation of the second Dutch edition. Several new genera and species are named therein, and one of these, *Lucoscombrus*,[34] seems to have been overlooked by ichthyologists. The following is a copy of the definition of this genus:

"*Lucoscombrus* mihi (*Gempylus* and *Thyrsites* Cuv.). Body elongate, compressed, with scales none or conspicuous only at the end of tail and along the lateral line. Teeth compressed, acute, unequal, in a single row in jaws, the middle of upper jaw much larger than the rest. Branchiostegous membrane with seven rays. Head elongate, depressed above; lower jaw produced beyond upper. Ventral fins thoracic. Dorsal fins two contiguous, and several free finlets behind the second.

Gempylus Cuv. Vomer and palate-bones edentulous. Ventral fins very small.

Sp. *Lucoscombrus serpens*, *Scomber serpens* Solander;—*Lucoscombrus coluber*, *Gempylus coluber* Cuv. *et* Val. *Poiss.* VIII. Pl. 221, &c.

Gempylus approaches *Lepidopus* by its much elongated body

Thyrsites Cuv. Teeth in vomer and palate-bones few, in a single row, conical Ventral fins small or moderate.

Sp *Lucoscombrus atun*, *Scomber atun* Lac., *Thyrsites atun* Cuv., Cuv *et* Val. *Poiss.* VIII. Pl. 219, Cuv. *R. Ani.*, *éd. ill.*, *Poiss.* Pl. 49, fig 1; a fish from the sea around South Africa, very common at the Cape of Good Hope, and known to the Dutch colonists as a palatable and very cheap food under the name of *Snoek* (Pike). This species attains a length of more than 3'."

In order to settle the taxonomic status of *Lucoscombrus*, I formally select *Lucoscombrus serpens* Van der Hoeven = *Gempylus serpens* Cuvier[35] as the logotype of *Lucoscombrus*, thereby making it an absolute synonym of *Gempylus* Cuvier[36] and *Lemnisoma* Lesson.[37] Cuvier's name appeared slightly earlier than Lesson's, not later as noted by Fowler,[38] whose action in using *Lemnisoma* was, however, justifiable at the time his paper was written.

Lucoscombrus atun Van der Hoeven = *Scomber atun* Lacépède[39] *Thyrsites atun* (Euphrasen).[40]

Genus Rexea *Waite* 1911.

1911 *Rexea* Waite, Proc. N. Zeal. Inst. 1910, ii (publ. Jany. 18, 1911), p. 49. Orthotype, *R. furcifera* Waite = *Gempylus solandri* Cuv. and Val.

1911 *Jordanidia* Snyder, Proc. U.S. Nat. Mus. xl, May 26, 1911, p. 527. Orthotype, *J. raptoria* Snyder.

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[34] Van der Hoeven.—Handbook of Zoology (trans. Clark), ii, 1858, p. 161.
[35] Cuvier.—Règn. Anim., ed. 2, ii, April, 1829, p. 200. Jamaica (Sloane).
[36] Cuvier.—Règn. Anim., ed. 2, ii, April, 1829, p. 200. Haplotype, *G. serpens* Cuv.
[37] Lesson —Voy. Coquille, Zool. ii, 1, 1830, p. 160.
[38] Fowler.—Proc. Acad. Nat. Sci. Philad. 1904 (1905), p. 767 and footnote.
[39] Lacépède.—Hist. Nat. Poiss. v, 1803, p. 679.
[40] Euphrasen.—K. Vet. Acad. Nya Handl. xii, 1791, p. 315, as *Scomber* (*fide* Sherborn).

1911 *Rexea* Waite, Rec. Canterbury Mus. i, 3, June 24, 1911, p. 235. Orthotype, *R. furcifera* Waite.

1913 *Jordanidia* Jordan, Tanaka, and Snyder. Cat. Fish. Japan in Journ. Coll. Sci. Univ. Tokyo xxxiii, 1913, p. 124. Type, *J. raptatoria* (sic) Snyder.

1915 *Jordanidia* McCulloch, Biol. Res. Endeavour iii, 3, 1915, p. 150.

1923 *Rexia* Jordan, Classif. Fish., 1923, p. 180. *Errore pro Rexea.*

The generic name *Rexea* was first proposed by Waite in the Proceedings of the New Zealand Institute, 1910, part ii, issued January 18, 1911, not the current Transactions and Proceedings, vol. xliii. Thus it has priority over *Jordanidia* Snyder, May, 1911. Most authors have regarded the original reference to *Rexea* as Rec. Canterbury Mus. i, 1911, but examination of that work shows a quotation of the earlier designation.

REXEA SOLANDRI (*Cuvier and Valenciennes*).

(Plate xxxiii, fig. 2.)

1832 *Gempylus solandri* Cuv. and Val., Hist. Nat. Poiss. viii, "1831" = January, 1832, p. 215. *Ex Scomber macrophthalmus* Solander MS. "New Holland" = Bay of Islands, New Zealand; 2/12/1769.

1843 *Gempylus solandri* Richardson, Ann. Mag. Nat. Hist. xi, Jan., 1843, p. 24. *Ex Scomber macropht[h]almus* Solander MS. New Zealand.

1843 *Gempylis solandris* Richardson, Rept. 12th. meet. Brit. Assn. Adv. Sci., 1842 (publ. late 1843), p. 20. New Zealand (Solander).

1873 *Thyrsites micropus* McCoy, Ann. Mag. Nat. Hist. (4), xi, May 1, 1873, p. 338. Tasmania. Type in National Museum, Melbourne, seen.

1874 *Thyrsites solanderi* Allport, Monthly Notices Pap. Proc. Roy. Soc. Tasm., 1873 (publ. 1874), p. 25 (notes identity of *micropus* and *solandri*).

1874 *Thyrsites micropus* McCoy, Monthly Notices Pap. Proc. Roy. Soc. Tasm., 1873 (1874), p. 50 (maintains that *micropus* and *solandri* are distinct [but confuses the latter with *Thyrsites atun* Euphrasen]).

1879 *Trichiurus solandri* Sauvage, Arch. Zool. Exper. viii, 1879, p. 28. Name only. New Holland.

1886 *Thyrsites solandri* Saville-Kent, Rept. Fish. Dept. Tasmania, 1886, p. 14 (occurrence in Tasmania).

1911 *Rexea furcifera* Waite, Proc. N. Zealand Inst. 1910, ii, Jan. 18, 1911, p. 49. New Zealand.

1914 *Jordanidia solandri* McCulloch, Abstr. Proc. Linn. Soc. N. S. Wales, July 29, 1914 (*Rexea furcifera* = *J. solandri*).

1915 *Jordanidia solandri* McCulloch, Biol. Res. Endeavour iii, 3, 1915, p. 150.

Apart from giving the above elaboration of the bibliography of *Rexea solandri*, the Tasmanian Kingfish or Tikati, I have little to add to the detailed account of this species given by McCulloch (*loc. cit.*, 1915). I present, however, a figure of the holotype of *Thyrsites micropus* McCoy, which is a mounted skin in the National Museum, Melbourne (No. 28841). I am indebted to Mr. J. A. Kershaw who allowed me to examine the specimen under his charge, and to Mr. A. Musgrave for the photograph he made of it.

Rexea solandri is rare in New South Wales, being occasionally trawled in our southern waters. Notes on its occurrence in New Zealand have been given by Phillipps.[41]

Family CARANGIDÆ.

MEGALASPIS CORDYLA (*Linnæus*).

(Plate xxxiii, fig. 1.)

1758 *Scomber cordyla* Linnæus, Syst. Nat., ed. 10, 1758, p. 298 (not synonymy).

1927 *Megalaspis cordyla* Whitley, Rec. Austr. Mus. xv, 5, 1927, p. 298, pl. xxiv, fig. 2 (references and synonymy).

The accompanying photograph, for which I am indebted to Mr. D. G. Stead, represents one of two specimens caught in Port Jackson in 1910. Numbers of this species were said to be present at the time. This northern species is thus evidently an occasional visitor to New South Wales waters.

TRACHURUS DECLIVIS (*Jenyns*).

(Plate xxxi, fig. 6.)

1841 *Caranx declivis* Jenyns, Voy. Beagle, Zool., iii, Fish. 1841, p. 68, pl. xiv. Princess Royal Harbour, King Georges Sound, West Australia.

1915 *Trachurus declivis* McCulloch, Biol. Res. Endeavour iii, 3, 1915, p. 125, pl. xxxiv, fig. 2.

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[41] Phillipps.—N.Z. Journ. Sci. Tech. i, 1918, p. 269; *ibid.* iv, 1921, pp. 118 and 124; and Phillipps and Hodgkinson; *ibid.* v, 1922, p. 94.

The Eastern Australian form may be found to differ slightly from the typical *Trachurus declivis* as collected by Charles Darwin in West Australia when large series from both regions can be compared, but, with the material at my disposal, I am unable to distinguish them satisfactorily even as subspecies.

The painting here reproduced was made by the late Allan R. McCulloch from a Port Jackson specimen in October, 1902. Young examples of this species have been found sheltering under jelly-fishes.

Family CEPOLIDÆ.

CEPOLA AUSTRALIS *Ogilby.*

(Plate xxx, fig. 4.)

1899 *Cepola australis* Ogilby, Proc. Linn. Soc. N. S. Wales xxiv, 1899, pp. 184-5. Port Jackson, New South Wales. Holotype in Austr. Museum (No. IA.3492).

1914 *Cepola australis* McCulloch, Biol. Res. Endeavour ii, 3, 1914, p. 109, pl. xxxiv, fig. 1.

A specimen, 241 mm. in total length, from Port Jackson, is shown in its natural colour in the figure reproduced herewith from a painting made in April, 1902, by A. R. McCulloch. It is one of two examples caught in Watson's Bay, near Sydney; Austr. Mus. No. I.5262. The species is evidently rare.

Family LETHRINIDÆ.

LETHRINUS DEVISIANUS, *nom. nov.*

1884 *Lethrinus ornatus* De Vis, Proc. Linn. Soc. N. S. Wales ix, 3, No. 29, 1884, p. 458. Wide Bay, Queensland. Type in Queensland Museum.

De Vis' name is preoccupied by *Lethrinus ornatus* Cuvier and Valenciennes[42] so *Lethrinus devisianus* is proposed as a substitute name, the holotype of the species being De Vis' specimen in the Queensland Museum, Brisbane.

Family MULLIDÆ.

MULLOIDICHTHYS *gen. nov.*

1849 *Mulloides* Bleeker, Verh. Bat. Gen. xxii, 1849, Percoid., p. 6. Logotype, *Mullus flavolineatus* Lacépède. Not *Mulloides* Richardson 1843.

[42] Cuvier and Valenciennes.—Hist. Nat. Poiss. vi, Sept., 1830, p. 310. *Ex* Kuhl and Van Hasselt MS. Java.

Mulloides Bleeker is preoccupied by *Mulloides* Richardson,[43] the haplotype of which is the New Zealand *Centropistes sapidissimus* Richardson. Thus *Mulloides* Bleeker (*non* Richardson) requires a new name and *Mulloidichthys* is proposed as a substitute, with *Mullus flavolineatus* Lacépède[44] as orthotype.

The three New South Wales species of the family Mullidæ are usually only caught in their immature stages in Sydney Harbour. In scientific literature they are usually separated by their dental characters which are often difficult to distinguish in small specimens, but Mr. McCulloch's paintings of Port Jackson specimens, reproduced here, will render their identification an easy matter.

UPENEUS SIGNATUS *Günther*.

(Plate xxxi, fig. 1.)

1867 *Upeneus signatus* Günther, Ann. Mag. Nat. Hist. (3) xx, 1867, p. 59. Sydney. Type in British Museum (Nat. Hist.).

1903 *Upeneus signatus* Tosh, Parliam. Rept. Mar. Dept. Qld., 1902-3 (1903), p. 19, pl. iii, fig. 2 (Southport, near Brisbane, Q.).

The figured specimen was caught by the late A. R. McCulloch at Elizabeth Bay in February, 1901. This species has a single row of teeth in the jaws and none on the vomer and palatines and therefore enters the genus *Upeneus* Cuv. and Val., *sensu lato*. The maxillary reaches nearly to the level of the anterior orbital margin and scales extend along top of head to level of nostrils.

Specimens are in the Australian Museum from Botany Bay and Port Jackson, New South Wales, and Lord Howe Island.

UPENEOIDES JEFFI (*Ogilby*).

(Plate xxxi, fig. 3.)

1846 ? *Upeneus tragula* Richardson, Rept. 15th meet. Brit. Assn. Adv. Sci., 1845 (publ. late 1846), p. 220. Canton.

1908 *Pseudupeneus jeffi* Ogilby, Proc. Roy. Soc. Qld. xxi, August, 1908, p. 19. Brisbane River. Type in Queensland Museum.

The Bar-tailed Red Mullet of Australia has been called *Upeneus tragula* by authors but that species was originally described from Canton, and has been grouped with such nominal forms as the extralimital *U. variegatus* Bleeker and *U. kiusiuana* Steindachner and Döderlein. As the accounts of these do not apply so well to Australian specimens as Ogilby's description of *Pseudupeneus jeffi*, I

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[43] Richardson.—Rept. 12th meet. Brit. Assn. Adv Sci., 1842 (publ. late 1843), p. 16. *Ex* Solander MS.

[44] Lacépède.—Hist. Nat. Poiss. iii, 1802, pp. 384 and 406. Mauritius

am using that specific name for the New South Wales species. A topotypical specimen of *U. jeffi*, 9½ inches long, from Moreton Bay (No. I.7732) has been compared by me with New South Wales specimens. It has teeth on jaws, vomer, and palatines; head scaly in advance of nostrils; and maxillary almost reaching vertical of anterior orbital margin.

Young specimens, up to five inches in length, are in the Australian Museum from Port Jackson, Parramatta River, and Shoalhaven River, New South Wales. One of these forms the subject of the accompanying figure which was made by the late A. R. McCulloch from a specimen collected by him in Elizabeth Bay, Port Jackson, in February, 1901 (No. I.4769). I have also examined specimens, six to nine inches long, from Moreton Bay, Queensland, south-eastern New Guinea, and Papua. Some small ones were collected by Dr. Paradice at Sir Edward Pellew Islands, Gulf of Carpentaria. These northern forms appear to be darker than the southern ones, but fresh specimens are needed before they can be differentiated.

UPENEICHTHYS POROSUS (*Cuv. and Val.*)

(Plate xxxi, fig. 2.)

1829 *Upeneus porosus* Cuvier and Valenciennes, Hist. Nat. Poiss. iii, April, 1829, p. 455. New Zealand (type-locality by present designation), and Tasmania.

The specimen figured was collected with the two preceding at Elizabeth Bay by Mr. McCulloch. Small specimens appear to be common in Sydney Harbour in late summer and autumn. I designate New Zealand as the type locality of this species as it seems possible that the New South Wales form may be distinct, but I have no specimens from New Zealand for comparison.

Family LABRIDÆ.

PICTILABRUS LATICLAVIUS (*Richardson*).

(Plate xxx, fig. 2.)

1839 *Labrus laticlavius* Richardson, Proc. Zool. Soc. Lond. vii, Nov., 1839, p. 99; Zool. Voy. Erebus and Terror, Fish. 1848, p. 128, pl. lvi, figs. 3-6. Port Arthur, Tasmania. Type in British Museum.

1881 *Labrichthys labiosa* Macleay, Proc. Linn. Soc. N. S. Wales, vi, 1, July, 1881, p. 88, pl. i, fig. 2. Port Jackson.

The figured specimen, 115 mm. in total length, was caught at Long Bay, near Sydney, New South Wales; August, 1908. Other specimens in the Australian Museum from this State came from Mosman, Botany Bay, Maroubra, and Narooma.

Family BODIANIDÆ.

CHŒRODON AMBIGUUS *Ogilby.*

(Plate xxxiii, fig. 4.)

1910 *Chœrodon ambiguus* Ogilby, New Fish. Qld. Coast, Dec. 20, 1910, p. 100. Off Double Island Point, Queensland; 33 fathoms.

A cotype of this species in the Australian Museum (No. I.12535) is here figured. This is a specimen, 6¾ inches long, which was received in exchange from the Amateur Fishermen's Association of Queensland in August, 1912.

CHŒRODON MONOSTIGMA *Ogilby.*

(Plate xxxiii, fig. 3.)

1910 *Choirodon monostigma* Ogilby, New Fish. Qld. Coast, Dec. 20, 1910, p. 102. Off Pine Peak, Queensland: 26 fathoms.

A cotype of this species (No. I.12518) is in the Australian Museum, having been received at the same time as the preceding species. It is five inches long and differs from *C. ambiguus* mainly in having rows of scales on the cheeks and a dark blotch on the dorsal fin.

Family AMPHIPRIONIDÆ.

AMPHIPRION MCCULLOCHI *Whitley.*

(Plate xxxiv, fig. 1.)

1929 *Amphiprion mccullochi* Whitley, Mem. Qld. Mus. ix (in press).

The accompanying figure, taken from the holotype of this species, was prepared too late for inclusion in my paper on "Some Fishes of the Order Amphiprioniformes," quoted above, so the opportunity is taken to reproduce it here.

Loc.—Lord Howe Island.

Family POMACENTRIDÆ.

Subfamily PARMINÆ.

PARMA MCCULLOCHI *Whitley.*

(Plate xxxiv, fig. 2.)

1929 *Parma mccullochi* Whitley, Mem. Qld. Mus. ix (in press).

The figure represents the holotype of this species which, like that of the last, is preserved in the Australian Museum. I am indebted to Miss Joyce K. Allan for illustrating this and the preceding

species and only regret that I neglected to have these excellent figures prepared sooner so that they could have appeared in the paper quoted.

Loc.—Rottnest Island, West Australia.

Family AMPHACANTHIDÆ.

AMPHACANTHUS VIRGATUS *Cuv. and Val.*

1835 *Amphacanthus virgatus* Cuvier and Valenciennes, Hist. Nat. Poiss. x, Sept., 1835, p. 133. Java.

1844 *Amphacanthus bifasciatus* Schlegel and Müller, Verh. Nat. Ges. Ned. overz. bezitt., Zool. (Pisc.), 1844, p. 14. Museum name. Batavia.

1844 *Amphacanthus virgatus* Schlegel and Muller, *loc. cit.*, pp. 11 and 14, pl. iii, fig. 1.

1850 *Amphacanthus virgatus* and *bifasciatus* Bleeker, Verh. Bat. Gen. xxiii, 1850, Teuth., pp. 7 and 11.

1861 *Teuthis virgata* Günther, Cat. Fish. Brit. Mus. iii, 1861, pp. 313 and 323.

1865 *Amphacanthus virgatus* Kner, Reise Novara, Zool., i, Fische, 1865, p. 209.

1875 *Teuthis virgata* Day, Fish. India i, Aug., 1875, p. 166, pl. xl, fig. 3.

1910 *Siganus virgatus* Jordan and Richardson, Check-List Fish. Philippine Archip. 1910, p. 42.

1911 *Amphacanthus virgatus* and *Teuthis virgata* Weber and Beaufort, Fish. Indo-Austr. Archip. i, 1911, pp. 63 and 394 (references).

Two specimens (Austr. Mus. Nos. IA.3596-7) from Port Darwin, North Australia, are the first to be recorded from Australia. Mr. L. B. Wilson, who collected them in November, 1927, states that they were caught in a fish trap in six fathoms of water with beef-bone bait. He had never caught this species by line, but the natives go on the reefs at low water during the night and attract the fishes by torchlight; they can then be speared at the surface. Mr. Wilson says he has eaten examples of this species. Other specimens are in the Australian Museum from the Philippine Islands and the Malay Archipelago.

Family CEPHALACANTHIDÆ.

1888 *Dactylopteridæ* Gill, Amer. Nat. xxii, 1888, pp. 356-358.
1908 *Cephalacanthidæ* Jordan and Richardson, Proc. U.S. Nat. Mus. xxxiii, 1908, p. 663.

1913 *Dactylopteridæ* Regan, Ann. Mag. Nat. Hist. (8) xi, 1913, p. 183.

Genus CEPHALACANTHUS *Lacépède* 1802.

1802 *Cephalacanthus* Lacépède, Hist. Nat. Poiss. iii, 1802, p. 323. Haplotype, *C. spinarella* Lacépède = *Gasterosteus spinarella* Linnæus. Spelled *Cephalocanthus* by Swainson, 1839.

1802 *Dactylopterus* Lacépède, Hist. Nat. Poiss. iii, 1802, p. 325. Logotype *D. pirapeda* Lacépède = *Gasterosteus spinarella* Linnæus. Preoccupies *Dactyloptera* Bonaparte 1841, another genus of fishes.

1815 *Cephacandia* Rafinesque, Analyse Nature 1815, p. 85. Substitute name for *Cephalacanthus* Lacépède (*fide* Jordan, Gen. Fish. i, 1917, p. 89).

1839 *Dactylophorus* Swainson, Nat. Hist. Classif. Fish. Amphib. Rept. ii, July, 1839, pp. 55, 179, and 262. Error for *Dactylopterus* Lacépède. Logotype, by present designation, *D. volitans* Swainson = *Trigla volitans* Linnæus = *Gasterosteus spinarella* Linnæus. Preoccupies *Dactylophora* De Vis 1884, another genus of fishes.

1846 *Cephalacanthia* Agassiz, Nomencl. Zool. Index Univ. 1846, p. 71. Emendation for *Cephacandia* Rafinesque.

1854 *Gonocephalus* Gray, Cat. Fish. coll. Gronow Brit. Mus. 1854, p. 105. Logotype *G. macrocephalus* Gray = *Gasterosteus spinarella* Linnæus. Preoccupied by *Gonocephalus* Kaup 1825, a genus of Reptiles.

Cephalacanthus is the larval form of the Flying Gurnard, *Dactylopterus*, but the name has page-priority in Lacépède's "Histoire Naturelle des Poissons." Two species of *Dactylopterus* were recognised by Lacépède, *D. pirapeda* and *D. japonicus*, but the latter is a synonym of *Lepidotrigla alata* (Gmelin). *Gonocephalus* Gray, from the MS. of Gronow, was not published until 1854, by which time it was preoccupied. Two species were described, *G. macrocephalus* and *G. microcephalus*, but both fall as synonyms, the first of *Gasterosteus spinarella* Linnæus and the second of *Dactylopterus orientalis* Cuvier.

CEPHALACANTHUS SPINARELLA (*Linnæus*).

Atlantic Flying Gurnard.

1648 *"Pirabebe"* Marcgrave, Hist. Brasil iv, 1648, p. 162. Brazil (*fide* Jordan and Evermann, 1898).

1738 *"Trigla capite parum aculeata"* Artedi, Ichth. iii, Gen. Pisc., 1738, p. 44, syn. 73. Mediterranean, etc. (not seen).

1754 *"Pungitius pusillus"* Linnæus, Mus. Adolph. Frid. i, 1754, p. 74, pl. xxxii, fig. 5 (*fide* Lütken, 1880).

1758 *Gasterosteus spinarella* Linnæus, Syst. Nat. ed. 10, 1758, p. 297. "Indies" = Guiana or Surinam (*fide* Cuvier, 1829). Based on *Pungitius*, Mus. Ad. Fr. i, p. 74, pl. 32, f. 5. Young specimen.

1758 *Trigla volitans* Linnæus, Syst. Nat. ed. 10, 1758, p. 302. *Ex* Artedi and Gronow. Mediterranean, etc.

1763 *"Trigla pinna singulari pinnis pectoralibus"* Gronow, Zoophylacium, 1763, p. 85, No. 285. Not refs. to East Indian species, which is *Dactyloptena orientalis* (Cuvier).

1766 *Gasterosteus spinarella* Linnæus, Syst. Nat. ed. 12, 1766, p. 492.

1766 *Trigla volitans* Linnæus, Syst. Nat. ed. 12, 1766, p. 498. Adds refs. to Browne's Jamaica 453, Marcgrave, Brasil 163, and to Seba, but latter is perhaps *Dactyloptena orientalis* (Cuvier).

1781 *Trigla volitans* Meuschen, Index Gron. Zoophyl. 1781, Pisces. Based on Zoophylacium, No. 285.

1788 *Trigla volitans* Bonnaterre, Tabl. Encycl. Meth., Ichth. 1788, p. 147, No. 12, pl. lxi, fig. 239 ("L'Ocean et la Mediterranée").

1789 *Gasterosteus spinarella* Gmelin, Syst. Nat. (Linn.), ed. 13, 1789, p. 1327.

1789 *Trigla volitans* Gmelin, Syst. Nat. (Linn.), ed. 13, 1789, p. 1346.

1792 *"Trigla tentabunda"* Walbaum, Piscium (Artedi) iii, 1792, p. 362. Non-binom. After *Cataphractus* Klein, Missus, which is after Catesby, Fish. Carolina iv, 1731, p. 44, pl. xiv, f. 1 (*fide* Jordan and Evermann, 1898).

1797 *Trigla volitans* Bloch, Ichtyologie x, 1797, p. 93, pl. cccli (refs. and synon.).

1801 *Trigla volitans* Bloch and Schneider, Syst. Ichth. 1801, p. 12.

1801 *Trigla fasciata* Bloch and Schneider, Syst. Ichth. 1801, p. 16, pl. iii, fig. 1. After *Corystion* Klein, Missus. No locality given.

1801 *Gasterosteus? spinarella* Bloch and Schneider, Syst. Ichth. 1801, p. 124.

1802 *Cephalacanthus spinarella* Lacépède, Hist. Nat. Poiss. iii, 1802, p. 323. "l'Inde" (= Surinam, *fide* Cuvier).

1802 *Dactylopterus pirapeda* Lacépède, Hist. Nat. Poiss. iii, 1802, p. 326. Mediterranean and open sea.

1803 *Gasterosteus spinarella* Shaw, Gen. Zool. iv, 2, 1803, p. 608.

1803 *Trigla volitans* Shaw, Gen. Zool. iv, 2, 1803, p. 622.

1810 *Trigla corvus* Rafinesque, Caratteri, 1810, p. 32, pl. vi, fig. 1. Sicily (not seen).

1815 *Polynemus sexradiatus* Mitchell, Trans. Lit. Phil. Soc. i, 1815, pl. iv, fig. 10. New York (*fide* Jordan and Evermann, 1898).

1818 *Callionymus pelagicus* Rafinesque, Amer. Month. Mag. Jan., 1818, p. 205. Atlantic Ocean (*fide* Jordan and Evermann, 1898).

1825 *Trigla corvus* Risso, Mem. Soc. Linn. Paris iii, 1825, p. 33 (*fide* Sherborn).

1826 *Trigla corvus* Risso, Hist. Nat. Eur. Merid. iii, 1826, p. 398.

1826 *Dactylopterus pirapeda* Risso, Hist. Nat. Eur. Merid. iii, 1826, p. 404.

1829 *Gasterosteus spinarella* Cuvier, Règn. Anim. ed. 2, ii, April, 1829, p. 162. Linnæus' "Indies" locality corrected to Guiana.

1829 *Trigla volitans* Cuvier and Valenciennes, Hist. Nat. Poiss. iv, Nov., 1829, p. 117.

1829 *Cephalacanthus spinarella* Cuvier and Val., Hist. Nat. Poiss. iv, 1829, p. 138, pl. lxxvii. Correct Linnæus' "Indies" locality to Surinam.

1836 *Cephalacanthus spinarella* Cuvier, Règn. Anim., discip. ed., 1836, p. 63, pl. xx, fig. 4. Guiana; Equatorial America, Atlantic shores.

1839 *Cephalocanthus* Swainson, Nat. Hist. Class. Fish. Amphib. Rept. ii, July, 1839, p. 55, fig. 10. No locality given.

1839 *Dactylophorus volitans, occidentalis, blochii, tentaculatus, fasciatus,* and *trigloides* Swainson, Nat. Hist., etc., July, 1839, p. 262. Names only.

1839 *Dactylopterus occidentalis* Swainson, Nat. Hist. etc., 1839, p. 415. W. Indies.

1839 *Dactylopterus blochii* Swainson, Nat. Hist., etc., 1839, p. 415. Based on *Trigla volitans* Bloch, pl. 351.

1839 *Dactylopterus tentaculatus* Swainson, Nat. Hist. etc., 1839, p. 416. Based on *Cataphractus* Klein, Missus = "*Trigla tentabunda*" Walbaum.

1839 *Dactylopterus fasciatus* Swainson, Nat. Hist., etc., 1839, p. 416. Based on *Corystion* Klein, Missus = *Trigla fasciata* Bloch and Schneider.

1839 *Dactylopterus trigloides* Swainson, Nat. Hist., etc., 1839, p. 417. Based on *Trigla corvus* Rafinesque.

1853 *Dactylopterus communis* Owen, Descr. Cat. Osteol. Ser. Mus. Roy. Coll. Surg. Eng., i, 1853, p. 56. New name associated with *Trigla volitans* Linnæus.

1854 *Gonocephalus macrocephalus* Gray, Cat. Fish. coll. Gronow Brit. Mus., 1854, p. 106. Based on Gronow, Zoophylacium, No. 285.

1860 *Dactylopterus volitans* Günther, Cat. Fish. Brit. Mus. ii, 1860, p. 221.

1860 *Cephalacanthus spinarella* Günther, Cat. Fish. Brit. Mus. ii, 1860, p. 224.

1877 *Corystion volitans* Pollen, Peches Madagascar in Rech. Faun. Madagas. iii, 1877, p. 63. Madagascar.

1880 *Dactylopterus volitans* Lütken, Spolia Atlantica, Vidensk. Selsk. Skr., 5 Række, natur. math. xii, 6, 1880, pp. 417-428 and 590, pl. i, figs. 1-5.

1898 *Cephalacanthus volitans* Jordan and Evermann, Bull. U.S. Nat. Mus. No. 47, ii, 1898, p. 2183, pl. cccxxiii, fig. 778.

1903 *Cephalacanthus volitans* Fowler, Science (2) xvii, 1903, p. 595 (*fide* Zoological Record).

1905 *Dactylopterus volitans* Gill, Ann. Rept. Smithson. Inst. 1904 (1905) p. 510, pl. ii, figs. 2-5, and pl. iii, figs. 1-3, and pl. iv, also text-fig. 1.

1908 *Cephalacanthus volitans* Jordan and Richardson, Proc. U.S. Nat. Mus. xxxiii, 1908, p. 664, footnote.

1913 *Dactylopterus volitans* Regan, Ann. Mag. Nat. Hist. (8) xi, 1913, p. 183, fig. 5*b* (osteology).

Mr. Melbourne Ward found a specimen of this species in the *Cephalacanthus* stage on Varadero Beach, Cuba (Austr. Mus. regd. No. IA.3563). When identifying it I noticed the complicated synonymy of this species which I have endeavoured to tabulate above. Cuvier noted that the young fish described by Linnæus as *Gasterosteus spinarella* came from Guiana and not from India or the East Indies as many authors had deduced. The "Indies" of Linnæus and other old authors may mean any extra-European locality and commonly either the West or East Indies. *Gasterosteus spinarella,* therefore, appears to be an American fish, and its name may not be applied to an Indo-Pacific species, as has sometimes been done. *G. spinarella* has been shown to be the larval form of *Trigla volitans* Linnæus, an Atlantic and Mediterranean species, by

Lütken and others, but since the name has page-priority, *Trigla volitans* becomes a synonym of it. Later synonyms, some of which have been generally overlooked, are also listed above.

The Indo-Pacific *Dactyloptena orientalis* (Cuvier) is sometimes referred to in literature on the Atlantic *Cephalacanthus spinarella* (Linnæus). As this species is found in Australia, I have tabulated its synonymy also, as follows:

Genus DACTYLOPTENA *Jordan and Richardson* 1908.

1908 *Dactyloptena* Jordan and Richardson, Proc. U.S. Nat. Mus. xxxiii, Feb. 28, 1908, pp. 664 and 665. Orthotype, *Dactylopterus orientalis* Cuvier and Valenc.

1908 *Ebisinus* Jordan and Richardson, Proc. U.S. Nat. Mus. xxxiii, Feb. 28, 1908, p. 664, footnote. Orthotype, *Dactylopterus cheirophthalmus* Bleeker.

It is not necessary for these names to fall as synonyms of *Corystion* Bleeker[45] who uses that generic term for *Corystion orientale* Bleeker = *Dactylopterus orientalis* Cuvier. I have not access to the original reference to this genus but quote from Weber and de Beaufort's index to Bleeker's papers.[46] Bleeker's name, perhaps taken from "*Corystion*" Klein, pre-Linnean, is preoccupied by *Corystion* Rafinesque 1810, another genus of fishes, so the use of *Dactyloptena* is validated.

DACTYLOPTENA ORIENTALIS (*Cuvier*).

Indo-Pacific Flying Gurnard.

1718 "*Terbang boudjou*" Renard, Poiss. Moluques i, 1718, pl. x, fig. 66. East Indies (not seen).

1724 "*Ikân terbang,* etc." Valentyn, Ind. Vet. et Nov. iii, 1724, p. 357, fig. 35. Amboina.

1758 "*Milvus ovidii*" Seba, Descr. Cabinet Seba, iii, 1758, p. 82, pl. xxviii, fig. 7 (not seen).

1803 "*Mooree-godoo*" Russell, Fish. Vizagapatam 1803, pl. clxi. Vizagapatam, India.

1829 *Dactylopterus orientalis* Cuvier, Règn. Anim. ed. 2, ii, April, 1829, p. 162. Based on Russell's pl. 161. Vizagapatam.

1829 *Dactylopterus orientalis* Cuvier and Valenciennes, Hist. Nat. Poiss. iv, Nov. 1829, p. 134, pl. lxxvi. Mauritius and Waigiou.

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[45] Bleeker.—Nat. Tijds. Diek. i, 1863, p. 236.
[46] Weber and de Beaufort.—Fish. Indo-Austr. Archip. i, 1911, p. 144.

1839 *Dactylophorus orientalis* Swainson, Nat. Hist. Classif. Fish. Amphib. Rept., ii, July, 1839, p. 262, and p. 417 as *Dactylopterus*.

1839 *Dactylophorus bispinosus* Swainson, Nat. Hist., etc., 1839, p. 262. *Nom. nud.*, described as *Dactylopterus* on p. 417. Based on Russell's pl. 161. Vizagapatam.

1839 *Dactylophorus chinensis* Swainson, Nat. Hist., etc., 1839, p. 262. *Nom. nud.*, described as *Dactylopterus* on p. 418. "In a box of Chinese dried fishes and crabs."

1843 *Dactyloptera orientalis* Temminck and Schlegel, Faun. Japon. Poiss., 1843, p. 37, pl. xv*a*.

1846 *Dactylopterus orientalis* Richardson, Rept. 15th meet. Brit. Assn. Adv. Sci. 1845 (publ. late 1846), p. 218. Japan and China.

1854 *Gonocephalus microcephalus* Gray, Cat. Fish. coll. Gronow Brit. Mus. 1854, p. 107. Based on Valentyn, Ind. Vet. et Nov. iii, p. 357, fig. 35. "In Mari Indico."

1854 *Dactylopterus japonicus* Bleeker, Nat. Tijds. Ned. Ind. vi, 1854, p. 396. Waka, Japan. Not *D. japonicus* Lacépède 1802, which is *Lepidotrigla alata* (Gmelin).

1860 *Dactylopterus orientalis* Günther, Cat. Fish. Brit. Mus. ii, 1860, p. 222.

1860 *Trigla dissimilis* Günther, Cat. Fish. Brit. Mus. ii, 1860, p. 223. *Nom. nud.* No locality.

1863 *Corystion orientale* Bleeker, Nat. Tijds. Dierk, i, 1863, p. 236. Ternate (*fide* Weber and de Beaufort).

1876 *Dactylopterus orientalis* Day, Fish. India 1876, p. 279, pl. lx, fig. 6.

1877 *Dactylopterus orientalis* Günther, Fische Südsee vi, 1877, p. 169 (Tahiti, Sandwich, Society, and Paumotu Islands).

1879 *Dactylopterus orientalis* Castelnau, Proc. Linn. Soc. N. S. Wales iii, 4, May, 1879, p. 351 (Sydney).

1882 *Dactylophorus orientalis* Tenison-Woods, Fish. and Fisher. N. S. Wales, 1882, p. 69.

1886 *Dactylopterus orientalis* Ogilby, Cat. Fish. N. S. Wales, 1886, p. 34.

1892 *Dactylopterus orientalis* Trebeck, Abstr. Proc. Linn. Soc. N. S. Wales, April 27, 1892, p. vii (Port Jackson).

1904 *Cephalacanthus spinarella* Waite, Mem. N. S. Wales Nat. Club, ii, Nov. 7, 1904, p. 49. Not *Gasterosteus spinarella* Linnæus.

1905 *Cephalacanthus orientalis* Jordan and Evermann, Bull. U.S. Fish. Comm. xxiii, 1, 1903 (July 29, 1905) p. 473, fig. 208 (Hilo, Hawaii).

1906 *Cephalacanthus spinarella* Stead, Fish. Austr. 1906, pp. 202 and 265, fig. *Non* Linnæus.

1908 *Dactyloptena orientalis* Jordan and Richardson, Proc. U.S. Nat. Mus. xxxiii, 1908, p. 666 (South Japan, Hawaii, East Indies).

1908 *Cephalacanthus spinarella* Stead, Ed. Fish. N. S. Wales, 1908, p. 115. *Non* Linn.

1912 *Dactyloptena orientalis* Snyder, Proc. U.S. Nat. Mus. xlii, 1912, p. 435, fig.

1913 *Dactylopterus orientalis* Weber, Siboga Exped., Fische, May, 1913, p. 517, fig. 109 (young).

1913 *Dactyloptena orientalis* Regan, Ann. Mag. Nat. Hist. (8) xi, 1913, pp. 175 and 183, figs. 1*a* and 5*a* (osteology).

1914 *Dactyloptena orientalis* Jordan and Thompson, Mem. Carneg. Mus. vi, 4, 1914, p. 284 (Japan). Important remarks on presence of lateral line.

1922 *Dactyloptena orientalis* McCulloch, Austr. Zool., ii, 3, 1922, p. 118, fig. 345*a* (N. S. Wales).

1922 *Dactyloptena orientalis* Jordan and Jordan, Mem. Carneg. Mus. x, 1, 1922, p. 57.

1925 *Dactyloptena orientalis* McCulloch and Whitley, Mem. Qld. Mus. viii, 1925, p. 165.

1927 *Dactyloptena orientalis* Whitley, Rec. Austr. Mus. xvi, 1, 1927, p. 29 (Queensland).

This species is sometimes found southwards of the Tropics as far as New South Wales. Specimens are in the Australian Museum from the following localities: Palmers Is. and Michaelmas Cay, Queensland; Trial Bay, Hastings River, Broken Bay, Port Jackson, Maroubra, and Manly, New South Wales; Malay Archipelago; Japanese Seas; Honolulu Aquarium; New Hebrides.

Later researches, based on large series of specimens, may demonstrate that several subspecies are geographically separable. The type locality of this species is Vizagapatam, India. For the present, the following nominal species may be considered as distinct: *Dactyloptena procne* Ogilby[47] from Queensland; *D. gilberti* Snyder[48]

[47] Ogilby.—Proc. Roy. Soc. Qld. xxiii, Nov, 1910, p 34 (*Ebisinus*).
[48] Snyder.—Proc. U.S. Nat. Mus. xxxvi, 1909, p. 604; and *ibid.* xlii, 1912, p. 435, pl. lvii, fig. 1 and text-fig. 1.

from Japan, with *D. jordani* Franz[49] as a synonym; *D. papilio* Ogilby[50] from Southern Queensland; *D. cheirophthalmus* Bleeker[51] from the East Indies; and perhaps *D. macracanthus* Bleeker[52] from Celebes.

Family SYNAPTURIDÆ.

SYNAPTURA NIGRA *Macleay.*

1880 *Synaptura nigra* Macleay, Proc. Linn. Soc. N. S. Wales, v, 1, Aug. 1880, p. 49. Botany Bay, New South Wales.

1882 *Synaptura fitzroiensis* De Vis, Proc. Linn. Soc. N. S. Wales, vii, 3, Oct. 28, 1882, p. 319. Mouth of Fitzroy River, Q. Type in Queensland Museum seen. *Id.* Saville-Kent, Gt. Barrier Reef, 1893, pp. 297 and 370. Spelt *S. fitzroyensis* by McCulloch and Whitley, Mem. Qld. Mus. viii, 1925, p. 162.

1883 *Synaptura cinerea* De Vis, Proc. Linn. Soc. N. S. Wales, viii, 2, July 17, 1883, p. 288. Moreton Bay, Q.

1926 *Brachirus fitzroiensis* and *orientalis* Norman, Biol. Res. Endeavour v, 5, June 15, 1926, p. 293 (refs. and synonymy).

Identity of Synaptura fitzroiensis De Vis.—I have examined a specimen in the Queensland Museum (Regd. No. I.11/79) which is evidently the holotype of *Synaptura fitzroiensis* De Vis and regard this species as inseparable from *S. nigra* Macleay.

The following characters of De Vis' specimen may be noted: Nostrils of the usual *Synaptura* type present, though described by De Vis as "On the upper lip three or four short thick tentacles." About 80 scales on straight part of lateral line system. Dorsal extending forward on to snout.

The following description was made in MS. by the late J. D. Ogilby from De Vis' type in the Queensland Museum:

"D.63; A.50; C.17; P.4-4; V.3/3. L.1.110; 1.tr.44/48.

"Depth of body 1·75, length of head 4·8 in length of body. Eye minute 11·5 in head and equal to interorbital width. Longest ray of right pectoral not quite twice the eye-diameter, 6·25 in head, and a little shorter than that of left pectoral, which is 5·8 in head. Caudal fin 1·35 in same. Scales everywhere ctenoid, except on the lower surface of head, where they are cycloid; both surfaces of vertical fins scaly to the tips; lips and anterior portion of snout naked on right side, without fold; a larger area naked on left side, cirrate. Eyes small and round, the upper partly in advance of the lower interorbital space scaly. Upper anterior nostril preceded by a wide triangular skinny valve, which barely reaches the posterior nostril, which is close in front of the eye near the lip. Cleft of mouth extending to below

[49] Franz.—Abh. Akad. München, Suppl. Band iv, Abh. 1, 1911, p. 80, pl. ix, fig. 72.
[50] Ogilby.—New Fish. Qld. Coast 1910, p. 127.
[51] Bleeker.—Nat. Tijds. Ned. Ind. vii, 1854, p. 494 (*Dactylopterus*).
[52] Bleeker.—Nat. Tijds. Ned. Ind. vii, 1854, p. 449 (*Dactylopterus*).

the anterior border of the lower eye; lips not fringed. Dorsal originating in front of the upper eye, its rays increasing in length backwards, its last nearly as long as the caudal. Anal similar to the dorsal. Caudal rounded. Ventrals small and equal, separated from anal by a considerable interspace. Lateral line straight from caudal to head, where it is bent upwards. Both sides now bleached to a uniform dirty white.

"L.177 (mm.), D.100, Head 37, Eye 3·2, Right pectoral 5·9, Left pectoral 6·4, Caudal 27, last dorsal ray 24."

Locality.—Mouth of the Fitzroy River, Rockhampton, Queensland; donated by T. McIlraith. Queensland Museum regd. No. I.11/79.

Synonymy.—Norman regards *Synaptura nigra* Macleay as a synonym of the Indian *S. orientalis* (Bloch and Schneider), but the Australian species is here regarded as distinct in consideration of his statement (*loc. cit.*, p. 294) that Australian specimens "appear to have (generally) a slightly deeper body, and often a somewhat different colouration." I also doubt whether *Solea foliacea* Richardson from China and *Synaptura cinerascens* Günther are conspecific with the Australian form as Norman suggests, and accordingly revive Macleay's name for our species.

Family GOBIIDÆ.

GLOSSOGOBIUS VOMER, *sp. nov.*

(Plate xxxii, fig. 1.)

D.vi/9; A.i/7; P.15. Sc. circa 34.

Depth (10 mm.) 5·8 in length to hypural joint (58). Head (18) 3·2 in same. Eye (3·5) 5·1, interorbital (2) 9, snout (5) 3·6 in head.

Head depressed, naked. A median pore between the eyes and a few smaller ones on top of head. A row of pores along the preopercular ridge and some regular subhorizontal rows along the cheeks. Nostrils inconspicuous with simple openings. Skin of chin plicate, without barbels. Isthmus narrow. Lower jaw longer than upper. Maxillary reaching to below middle of eye. A band of short pointed teeth in each jaw, the inner teeth depressible. Tongue large, with a median notch.

Body elongate, tapering, rounded anteriorly, compressed posteriorly; covered with large scales with narrow, weakly ctenoid edges. No pit or fleshy lobes on shoulder. A naked area around and in front of the vent and genital papilla. First dorsal with six spines, lower than the second. Anal similar to second dorsal but with shorter base. Pectorals almost reaching origin of anal, without silk-like rays. Ventrals united, not reaching vent. Caudal irregularly rounded.

General colour, after long preservation, yellowish-brown becoming lighter below. Head, body, and fins, with brown punctulations which are denser on the back, around the eyes, and on the operculum. A brown mark on shoulder and a prominent blackish blotch on the spinous dorsal membrane. Eye bluish.

Described and figured from the unique holotype, a specimen 2¾ inches long. Austr. Mus. regd. No. I.11234.

Loc.—Swan River, Western Australia; collected by A. Abjornson.

Family SALARIIDÆ.

I have noted over two hundred specific names which have been used in literature under the genus *Salarias, sensu lato*, and it is therefore hardly surprising that some names have been twice applied to different fishes. Some new names are therefore necessary for some of the preoccupied ones discussed hereunder.

SALARIAS DAYI *nom. nov.*

The name *Salarias alboguttatus* Day[53] is preoccupied by *S. alboguttatus* Kner,[54] a Samoan species later figured by Günther.[55] Day's species, which was described from the Andaman Islands, requires a new name and may be called *Salarias dayi*.

"SALARIAS FURCATUS *Johnstone*."

De Vis[56] described *Salarias furcatus* from Moreton Bay, Queensland, but McCulloch and McNeill[57] regarded this species as a doubtful *Petroscirtes*. The preoccupied name, *Salarias furcatus*, was, however, proposed for a very different fish by Johnstone.[58] Johnstone's species apparently does not require a new name as Weber[59] regards it as a synonym of *Salarias bicolor* Day.[60]

SALARIAS LUCTUOSUS *nom. nov.*

Salarias andersoni Jordan and Starks[61] from Japan is rendered invalid as a name by *Salarias andersonii* Day[62] from Galle. The Japanese species may be re-named *Salarias luctuosus*.

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[53] Day.—Fish. India ii, Aug., 1876, pp. 329 and 334.
[54] Kner.—Sitzb. Akad. Wiss. Wien lvi, 1867, p. 724, fig. 6.
[55] Günther.—Journ. Mus. Godeff. xiii (Fische Sudsee vi), 1877, p. 205, pl. xviii, fig. B.
[56] De Vis.—Proc. Linn. Soc. N. S. Wales ix, 3, Nov. 29, 1884, p. 696.
[57] McCulloch and McNeill.—Rec. Austr. Mus. xii, 1918, p. 23.
[58] Johnstone.—Suppl. Rept. Pearl Fisher. xv in Rept. Pearl Oyster Fish. G. Manaar, pt. ii, 1904, p. 213, pl. i, fig. 4.
[59] Weber.—Fische Siboga-Exped., 1913, p. 533.
[60] Day.—Suppl. Fish. Ind., 1888, p. 798, *ex* Tickell MS.
[61] Jordan and Starks.—Proc. U.S. Nat. Mus. xxx, June 4, 1906, p. 703, fig. 11.
[62] Day.—Fish. India ii, Aug. 1876, pp. 329 and 331.

SALARIAS SANNA *nom. nov.*

The writer was unconsciously the culprit who gave a preoccupied name to a Santa Cruz Archipelago species which was called *Salarias macneilli coloratus* in Rec. Austr. Mus. xvi, 1928, p. 229. This name, I have since discovered, is invalidated by *Salarias quadricornis coloratus* Klunzinger[63] described from the Red Sea. My Santa Cruz form may now be elevated to full specific rank with the new name *Salarias sanna*.

Family ANTENNARIIDÆ.

ANTENNARIUS COMMERSONII (*Cuvier*).

(Plate xxxi, fig. 5.)

1798 *"La Lophie commerson"* Lacépède, Hist. Nat. Poiss. i, 1798, p. 327. Vernacular name only. "East African Seas."

1817 *Chironectes commersonii* Cuvier, Mem. Mus. d'Hist. Nat. iii, Oct. 1817, p. 431, pl. xviii, fig. 1. Based on Lacépède 1798. Mauritius.

1855 ? *Antennarius moluccensis* Bleeker, Nat. Tijdschr. Ned. Ind. viii, 1855, p. 424. Amboina.

The coloured figure depicts a specimen from Watson's Bay, near Sydney (Austr. Mus. No. I.5263), caught in May, 1902. This species is not so common in New South Wales as *A. striatus* Shaw. The type-locality of *A. commersonii* is evidently near Mauritius and it seems probable that the Australian form regarded as that species may not be typical.

Specimens are in the Australian Museum from Port Jackson and Port Hacking, New South Wales.

PTEROPHRYNOIDES HISTRIO (*Linnæus*).

(Plate xxxi, fig. 4.)

1758 *Lophius histrio* Linnæus, Syst. Nat., ed. 10, 1758, p. 237; ed. 12, 1766, p. 403. Pelagic, in floating weed, China and Brazil. Type-locality, Sargasso Sea (*vide infra*).

The coloured figure is taken from a New South Wales specimen; Austr. Mus. No. I.5255.

Osbeck[64] found this species, which is said to have a world-wide distribution, among Sargazo weed in the North Atlantic Ocean in

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[63] Klunzinger.—Verh. Zool.-Bot. Ges., Wien, xxi (Synops. Fische Roth. Meeres ii), 1871, p. 488.

[64] Osbeck.—Voy. China and E. Indies (trans. J. R. Forster) ii, 1771, pp. 112 and 114. On p. 381 of the same volume, in Forster's Faunula Sinensis, "*Lophius histrio*. Amœn. Acad. 4, p. 246" is listed from China.

1752 and remarked, in his account of it, "Perhaps Providence has clothed this fish with *fulcra* resembling leaves, that the fishes of prey might mistake it for sea-weed, and not entirely destroy the breed." Linnæus practically based his name *Lophius histrio* on the account given in the original Swedish edition of Osbeck's Voyage, so the type-locality of the species is in the "Grass Sea," North Atlantic Ocean, between 17° and 24° N. lat. and 37° and 39° W. long.

Family ALUTERIDÆ.

(*Monacanthidæ, auctt.*)

Aluterus Cloquet[65] is an earlier name than *Monacanthus* Schinz,[66] the first Latinization of "Les Monacanthes" Cuvier,[67] so the family hitherto known as Monacanthidæ should be named Aluteridæ.

MEUSCHENIA, *gen. nov.*

Orthotype, *Monacanthus trachylepis* Günther 1870.

Gill-opening short, oblique, below eye. Dorsal spine originating over eye, with two rows of strong barbs posteriorly and two shorter rows of weak barbs anteriorly; a small second dorsal spine. Dorsal and anal fins not angulate, with more than thirty rays. A small immovable ventral spine; dewlap-like ventral flap not developed.

Body elongate, its depth being one-third of total length, less than half length to hypural, and more than length of head. Scales erect, with three to eight strong spines: no cutaneous flaps on body or fins. Length of caudal peduncle less than that of interdorsal space. Normally four strong spines on each side of caudal peduncle, though these may be weak or accompanied by extra rudimentary spines.

Named after Friedrich Christian Meuschen, an eighteenth century zoologist, whose names for fishes I am discussing in another paper in these Records.

Affinities.—The type-species of *Meuschenia* was originally described as a *Monacanthus*, but cannot be retained in that genus because the genotype of the latter is *Balistes chinensis* Bloch 1786, a species, described by Osbeck in a pre-Linnean work from the Chinese Sea,[68] which has a dewlap-like flap near the prominent

[65] Cloquet.—Dict. Sci. Nat., ed. 2, i, Oct. 1816, suppl., p. 135.
[66] Schinz.—Das Thierreich (Cuvier) ii, 1822, p. 225. Mr. Iredale regards the latinizations of Oken, Isis, 1817, p. 1183 as *nomina nuda*.
[67] Cuvier.—Règn. Anim. ed. 1, ii, "1817" = Dec. 1816, p. 152 Vernacular only
[68] Osbeck.—Voy. China and E. Indies (trans. J. R. Forster), i, 1771, p. 177; Reise Ost-Indien China, 1765, p. 147 (*fide* Sherborn); and Bloch, Nat. ausl. Fische ii, 1786, p. 29 (*fide* Sherborn); Ichtyologie v, 1787, p. 26, pl ciii, fig. 1 (China). This species was called *Balistes sp.* by Meuschen, 1781

ventral spine and is a smaller fish with a relatively deeper body. Neither is *Meuschenia trachylepis* a *Cantherhines* as, in the original description of that genus by Swainson[69] the characters given are "Body smooth or granulated; pelvis prominent; tail smooth" and "no spines on the side of the tail." The haplotype of *Cantherhines* is *Monacanthus nasutus* Swainson (*loc. cit.*), which is a new name for *Balistes sandwichiensis* Quoy and Gaimard.[70] It may be of interest to note that I have before me Swainson's copy of Quoy and Gaimard's work and that a note in his handwriting is pencilled in the margin against *B. sandwichiensis* stating "*Monocanthus*. no spines. tail even." An excellent figure of *Cantherhines sandwichiensis* (Q. and G.) has been given by Jordan and Evermann,[71] from which it is seen that caudal spines may be present. This character has, since Swainson's day, been regarded as sexual. However, there is no possibility of confusing this Hawaiian species with *Meuschenia* as it has a deep body, and dewlap-like ventral flap. These characters are also present in *Liomonacanthus* Bleeker,[72] judging from the figure of the genotype, *L. pardalis*, in the Atlas Ichthyologique.

The genotype of *Pseudomonacanthus* Bleeker,[73] the third genus into which *Monacanthus trachylepis* Günther has been placed by authors, is *Monacanthus macrurus* Bleeker,[74] being designated in the Atlas Ichthyologique. This species has a ventral spine and dewlap-like flap and less fin-rays than *M. trachylepis*. Bleeker's figure[75] clearly shows that it is not congeneric with *Meuschenia*. Jordan and Fowler[76] have applied the name *Pseudomonacanthus* to a very different form, *Monacanthus oblongus* Temminck and Schlegel, but whilst this species, which is Japanese, is nearer *M. trachylepis* than is *M. macrurus*, it is still to be regarded as generically distinct because it has a velvety integument and pointed fins, and is nearer "*Pseudomonacanthus*" *degeni* Regan, and *ayraudi* Quoy and Gaimard from Australia.

MEUSCHENIA TRACHYLEPIS (*Günther*).

(Plate xxxii, figs. 2, *a* and *b*).

1870 *Monacanthus trachylepis* Günther, Cat. Fish. Brit. Mus., viii, 1870, p. 248. "Australia"; probably Sydney. Type in Brit. Mus. (Nat. Hist.).

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[69] Swainson.—Nat. Hist. Classif. Fish. Amphib. Rept. ii, July 1839, p 194 and on 327, as *Cantherines*. Emended to *Canthorhinus* by Agassiz, Nomencl. Zool, 1846, Index Univ., and used later by Gill

[70] Quoy and Gaimard.—Voy. Uran. Physic, Zool., Oct 1824, p. 214. Sandwich Is.

[71] Jordan and Evermann.—Bull. U.S. Fish. Comm. xxiii (1903), i, 1905, p 418, fig. 183.

[72] Bleeker.—Ned. Tijdschr. Dierk. iii, 1866, p. 13 (*fide* Jordan).

[73] Bleeker.—Ned. Tijdschr. Dierk. iii, 1866, p. 11 (*fide* Jordan, Gen Fish. iii, 1919, p. 340).

[74] Bleeker.—Nat. Tijdschr. Ned. Ind. xii, 1856, p. 226. Nias

[75] Bleeker.—Atlas Ichthyologique v, 1869, p. 134, pl. ccxxviii, fig. 2.

[76] Jordan and Fowler.—Proc. U.S. Nat. Mus xxv, 1902, p. 268.

1873 ? *Monacanthus baudinii* Castelnau, Proc. Zool. Acclim. Soc. Vict., ii, May 10, 1873, p. 55. Victorian coast and Hobart.

1879 *Monacanthus trachylepis* Klunzinger, Sitzungb. Akad. Wiss. Wien lxxx, 1, 1879, p. 422 (98 of reprint).

1879 ? *Monacanthus rudis* Castelnau, Proc. Linn. Soc. N.S. Wales, iii, 4, May, 1879, p. 399. Sydney. Not *M. rudis* Richardson, Trans. Zool. Soc. Lond., iii, 1844, p. 166, from Tasmania and not *M. rudis* Castelnau, Proc. Zool. Acclim. Soc., ii, 1873, p. 54.

1881 *Monacanthus trachylepis* Macleay, Proc. Linn. Soc. N.S. Wales, vi, 2, Sept. 12, 1881, p. 313. Broken Bay, N.S.W.

1893 *Monacanthus trachylepis* Ogilby, Ed. Fish. Crust. N.S. Wales, 1893, p. 195.

1904 *Pseudomonacanthus trachylepis* Waite, Mem. N.S. Wales Nat. Club, i, 1904, p. 56.

1915 *Cantherines trachylepis* Ogilby, Commerc. Fish. Fisher. Qld., 1915, pp. 43 and 48.

1916 *Cantherines trachylepis* Cockerell, Mem. Qld. Mus., v, 1916, p. 57 (scales).

1922 *Cantherines trachylepis* McCulloch, Austr. Zoologist, ii, 3, 1922, p. 126, fig. 363e; Check-List, 1922, p. 100.

This species has been well described by Ogilby, 1893. The accompanying figure is of a specimen (Austr. Mus. No. I.6775) from Maroubra, New South Wales, presented by A. R. McCulloch, May, 1904. Others are in the Museum from Port Stephens and Port Jackson.

Meuschenia trachylepis is apparently allied to the following species from Australia:

Balistes lemniscatus Lacépède, Ann. Mus. d'Hist. Nat., May, 1804, pp. 202 and 211. "New Holland" (Baudin); probably Bass Strait or Kangaroo Island.

Aleuterius variabilis Richardson, Zool. Voy. Erebus and Terror, Fish. 1846, p. 67, pl. lii, figs. 1-7, *Monacanthus* on plate. King George's Sound, W. Australia. The Eastern Australian form of this species has been identified with *Balistes hippocrepis* Quoy and Gaimard, Voy. Uran. Physic., Zool., Oct. 1824, p. 212. Mauritius. *Monacanthus multiradiatus* Günther, Cat. Fish. Brit. Mus., viii, 1870, p. 248, is similar.

Pseudomonacanthus galii Waite, Rec. Austr. Mus., vi, 2, Sept. 15, 1905, p. 79, pl. xvi. Sharks Bay, W. Australia.

Aleuteres maculosus Richardson, Proc. Zool. Soc. Lond., viii, Aug., 1840, p. 28; Trans. Zool. Soc., iii, Jan., 1844, p. 170 Port Arthur.

Monacanthus edelensis Castelnau, Vict., Offic. Rec. Philad. Exhib., 1875, p. 50. Fremantle.

Monacanthus convexirostris Günther, Cat. Fish. Brit. Mus., viii, 1870, p. 248. George Town, Tasmania and New Zealand. Apparently not *Pseudomonacanthus convexirostris* Waite (Rec. Canterbury Mus., i, 3, 1911, p. 257, pl. lvii). Comparison of the types of *M. convexirostris* and *M. trachylepis* with one another and with Waite's figure would solve this problem.

Genus ALUTERUS *Cloquet* 1816.

1816 *Aluterus* Cloquet, Dict. Sci. Nat. (Levrault), ed. 2, i, October, 1816, suppl. p. 135. (Ex Cuvier MS.) Logotype, *A. monoceros* (Linnæus).

1816 "*Les Alutères*" Cuvier, Règn. Anim. ed. 1, ii, "1817" = Dec., 1816, p. 153; ed. 2, ii, 1829, p. 374. Vernacular only.

1817 *Alutera* Oken, Isis, 1817, p. 1183 (*fide* Sherborn, and Jordan). *Nomen nudum.*

1822 *Alutera* Schinz, Das Thierreich (Cuvier), ii, 1822, p. 256. Based on Bloch t. 147.

1831 *Aluteres* Lesson, Voy. Coquille, Zool. ii, 1831, p. 105.

1832 *Aluteres* Voigt, Das Thierreich (Cuvier), ii, 1832, p. 488.

1840 *Aleuteres* Richardson, Proc. Zool. Soc. Lond., viii, Aug. 1840, p. 28.

1846 *Aleuterius* Richardson, Zool. Erebus and Terror (Fish. 1846), p. 67.

1846 *Alutarius* Agassiz, Nomencl. Zool., 1846, Index Univ. Emendations for "*Alutera* Cuvier" and *Aluteres* Lesson.

This generic name has been spelt in various ways and quoted as of Cuvier.. That author, however, only used the vernacular. Jordan, in the Genera of Fishes, quotes *Alutera* Oken 1817 as valid, but Mr. T. Iredale, who has seen Oken's work in London, regards his names as *nomina nuda.* However, argument upon this point is obviated by reference to Sherborn's Index Animalium where all the various spellings are correctly indexed, and the original and valid reference to Cloquet 1816 is given. Reference to the Dict. Sci. Nat., which was published before Cuvier's vernacular, shows that Cloquet had introduced *Aluterus* from Cuvier's MS. and gave a full definition with two species: *Aluterus monoceros*, based on

Balistes monoceros Linnæus, and *Aluterus kleinii,* based on *Balistes kleinii* Linnæus and *B. auwawa* Artedi. *Balistes monoceros* Linnæus was formally designated the genotype by me on the third page of Additions in the second edition (*i.e.* impression) of McCulloch's Fishes and Fish-like Animals of New South Wales, 1927.

ALUTERUS MONOCEROS (*Linnæus*).

1758 *Balistes monoceros* Linnæus, Syst. Nat., ed. 10, Jan. 1, 1758, p. 327. Based on Mus. Ad. Fr. 2; *Balistes monoceros* Osb. iter. 110; and *"Unicornu,"* etc., Catesb. car. 2, t. 19. Habitat in Asia, America [= near Hong Kong].

Two species of fishes are united by Linnæus under one name, *Balistes monoceros*. One is an American, the other an Asiatic form, but as the name is taken directly from Osbeck, it must be applied to the species described by Osbeck which is probably the same as the one in the Ad. Fr. Mus. The locality "Asia" can be determined by reference to Osbeck's Iter Chinensis. The Swedish account quoted by Linnæus is not available to me, but I have Forster's translation from the German edition which gives the type-locality as 22° 4′ N. Lat., off the White Rock, Chinese Coast, somewhere about Hong Kong. Osbeck's names in the text of his Voyages are not accepted in taxonomy as the book is a translation of a pre-Linnean work. The list of species at the end of the second volume given by Forster[77] in the Faunula Sinensis, 1771, is valid. The fish names are as follows: p. 331 (Amphibia nantes) *Lophius histrio*, *Balistes monoceros*, *B. vetula*, *B. scriptus*, *B. nigro punctatus*, *B. sinensis*, *Tetrodon hispidus*, *T. ocellatus*; p. 332 (Pisces) *Trichiurus lepturus*, *Gobius niger*, *G. eleotris*, *G. anguillaris*, *G. pectinirostris*, *Chætodon pinnatus*, *C. argenteus*, *Sparus nobilis*, *S. chinensis*, *Labrus opercularis*, *L. chinensis*, *Scomber trachurus*; p. 333 *Clupea thrissa*, *C. mystus*, *C. sinensis*, *C. lanatus*, *Cyprinus auratus*, *C. cantonensis*.

As Osbeck's work is rare, I take this opportunity to transcribe below Forster's translation of his account of *Aluterus monoceros* and of a second species, *"Balistes scriptus."* The latter name should apparently date from Forster 1771, not from Gmelin 1789; the species is the haplotype of *Osbeckia* Jordan and Evermann.[78] A nominal species of *Osbeckia* is recorded from New South Wales, where the genus is represented in the Tasman Sea. This was originally described as *Monacanthus macrurus* by Macleay,[79] but the name being preoccupied by Bleeker,[80] was changed to

[77] Forster.—Faunula Sinensis, in Osbeck, Voy. China and E. Indies (trans. Forster), ii, 1771, pp. 321-338.
[78] Jordan and Evermann.—Bull U.S. Nat. Mus. xlvii, 2, 1898, p. 1719.
[79] Macleay.—Proc. Linn. Soc. N. S. Wales vi, 2, Sept. 12, 1881, p. 330.
[80] Bleeker.—Nat. Tijdschr. Ned. Ind. xii, 1856, p. 226.

M. maculicauda by Ogilby[81] and the species was recorded as *Osbeckia maculicauda* by McCulloch.[82] Probably this species is *O. scriptus* which is oceanic in habitat or pelagic and perhaps strays southward to the waters between New South Wales and Lord Howe Island. I saw a specimen when aboard the Research Ship "Dana" and have picked up a dead *Aluterus monoceros* on Maroubra Beach near Sydney.

"The 8th of August, 22° 4′ N.L.

PIEDRA *Blanca*, or the *White rock*, came within our sight, towards noon. The wind abating, the heat became intolerable. Towards the evening we anchored.

BALISTES *Monoceros* is a species of fish which looks like a flounder at a distance, and has almost the same taste, but is not so fat. The fish was half a foot long, and its body covered with a dark-grey rough skin. We caught several with a hook, and this afforded me an opportunity of describing them.

ON each side is a *spiracle*, and next to it, within the skin, two transversal bones: the first *dorsal fin* near the eyes, consists of a reversed brittle bone, which is armed with little hooks; it is the length of a finger's breadth, and a little longer than the other fins: the second *dorsal fin* has forty-seven rays: the *pectoral fins* are the least; each has thirteen rays: the *ventral fins* are wanting; in their stead is a long bone under the skin: the *anal fin* is opposite to the second dorsal fin, and has 51 rays: the *tail* has 12 ramose rays: the *mouth* is oblong and narrow: the lower *jaw* is somewhat longer than the upper; on each side of it stand three pointed, broad *teeth*, connected together below, of which the middlemost is split: the *lips* are moveable."

"The 9th of August.

THE ship hardly moved from the place where it was the day before. We saw besides *Piedra Blanca* the isle of *Lantoa*, and some other isles on the *Chinese* coast, on our right."

"The 10th of August.

IN the forenoon the sky was clear, but the wind against us.

BALISTES *scriptus*. Catesby, vol. ii. 27. A fish equal in size and appearance to the *Balistes monoceros*, but marked over the whole body as it were with blue letters of an Eastern language, was caught here, and put into *Spanish* brandy; but the fine colours vanished as soon as it was dead."[83]

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81 Ogilby.—Cat. Fish. N. S. Wales in Rept. Commis. Fisher, N.S.W. 1886 (1887), Appendix A, p. 64.

82 McCulloch.—Austr. Zoologist ii, 3, 1922, p 127.

83 Osbeck.—Voy. China and E. Indies (trans. J R. Forster) i, 1771, pp 172-174.

STUDIES IN AUSTRALIAN CARCINOLOGY.

No. 3.*

By

Frank A. McNeill, Zoologist, Australian Museum.

(Plates xxxv-xxxvii, and Figures 1-4.)

This paper deals with several local species considered to have been previously insufficiently described or incorrectly assigned generically. The description of a new species of *Speocarcinus*, the first to be recognized from Australia, is also submitted, as well as some important records of other species.

Family PALÆMONIDÆ.

Genus Palæmon *Fabricius*.

Subgenus Parapalæmon.

Palæmon (Parapalæmon) australis (*Ortmann*).

(Plate xxxv.)

Palæmon sp. ? (*P. australis*), Ortmann, Zool. Jahrb., Syst. v, 1890, p. 708.

Palæmon australis McNeill, *in* The Australian Encyclopædia, ii, Sydney, 1926, p. 325, and fig. *Id.*, Hale, Trans. Roy. Soc. South Australia., li, 1927, p. 309; and Handbook Flora and Fauna S. Australia, British Science Guild (S. Austr. Branch) —Crust. S. Austr., Pt. i, 1927, p. 60, fig. 56.

Description.—Carapace and abdominal region smooth. A "Ͻ"-shaped depression behind the eye. Cervical groove distinct laterally. Distinct antennal and hepatic spines present.

Rostrum lanceolate, deep in lateral view, and straight or with the tip inclined slightly upwards; it reaches beyond the antennular peduncle, but rarely to the end of the antennal blade. Dorsally it bears 8-10 small teeth, usually 9; two or three of these are situated on the carapace just behind the posterior limit of the orbit, and are usually more widely spaced than the others. Three to five teeth occur on the lower margin of the rostrum, usually four. The lateral ridge extends along the middle of the rostrum, so that the structure is as broad below as above.

* For No. II, see Rec. Austr. Mus., xv, 1, 1926, p 100.

Telson terminating in a fixed acute spine, immediately to the sides of which are two pairs of movable spines, the inner pair being large and distinct. Two more pairs of small movable spines are situated on the lower half of the telson above, and near its articulation with the sixth abdominal somite is a distinct bunch of long setæ. The distal extremity is also adorned with a bunch of setæ originating below the terminal spines.

A small but prominent spine is present on the joint at the base of the antennal spine. The antennal blade extends for nearly one-third of its length beyond the distal joint of the antennular peduncle. The third, or external, maxillipeds, when straightened, reach about as far forward as the distal extremities of the antennular peduncles.

When the first pair of legs is fully extended forward, the carpal joints extend well beyond the antennal blade, often to the extent of over one-third, but less than one-half of their length. These chelate limbs are noticeably more slender than the last three ambulatory pairs. The second pair of chelate limbs is very massive and heavy, and covered with minute spinules; one limb is always larger than the other, and the ischium of the larger is more than half the length of the merus, which is approximately equal to that of the carpus. The palm is longer than the carpus, but its length varies somewhat with age and individually; in the smaller companion limb the palm is about the same length as the carpus, and sometimes slightly shorter. The fingers of the two large hands may be about as long as their respective palms, but are often considerably shorter, particularly in the largest specimens; they are covered with a thick growth of hair, and each has two prominent more or less triangular teeth on the proximal half, those of the immovable finger being the largest. In aged examples the distal half of the fingers is minutely dentate. The ischium of the large chelate limbs is strongly compressed laterally, and there is a longitudinal groove on its inner surface. The meral and carpal joints are cylindrical and thicker distally. The palm is again compressed, with its angles rounded.

The two anterior pairs of ambulatory limbs are of equal length; the third pair is slightly longer. All the joints are clothed with fine setæ, and the propodi are armed below with a row of minute and elongate movable spines. The tips of the propodi of the last pair of limbs each bear a distinct brush of fine setæ below.

The above description applies to a series of 18 adult males in which the length of the carapace, from the tip of the rostrum to the posterior margin, measures 21·5 to 33 mm.

Twenty-three adult females, of which 15 are bearing eggs, have the chelipeds of the same proportions as the males, but they are comparatively much smaller in size. One specimen has only seven

teeth on the rostrum above. The eggs are large and few in number; their average length is 1 mm., and just before incubation they may measure 1½ mm.

Juvenile specimens differ principally in the proportions of the second or larger chelate limbs, which are commonly equal in size, and smooth. The fingers are longer, sometimes being much longer than the palm, and are devoid of teeth. The rostrum, too, commonly reaches to the end of the antennal blade.

So far as can be ascertained, no detailed description of this species has been published, and certainly none has appeared in any Australian journal. Published figures have also been inadequate. It is therefore hoped that the description of the present unique series of specimens in the Australian Museum will serve to put the future study of the species on a sound basis.

Locality.—Horton River at Pallal, near the town of Bingara, New South Wales.—A large series collected by the late Allan R. McCulloch.

Variation within the species.—It appears that *Palæmon* (*P.*) *australis* has a most extensive range in the freshwater river systems of the eastern and southern portions of Australia, and that many perplexing racial forms exist similar to those exhibited by the Australian freshwater Atyidean shrimp *Paratya* (*P.*) *australiensis* (Kemp).[1] Possibly varieties of the species also occur. Unfortunately, however, our present material is meagre, and it is practically useless to base descriptions on anything but complete series of specimens from individual localities as in the present instance. The figure of the southern Australian form provided by Hale (*tom. cit.*) has the general facies of the form described above, but the hands are not clothed as in the series from Pallal, and there is no sign of the well developed teeth on the cutting edges of the fingers. Obviously this form of the species belongs to a distinct race, or is even a variety of the species.

Discussion and Status.—In 1890 (*tom. cit.*) Ortmann included under "Palæmon sp.?" several southern Queensland specimens from freshwater at Gayndah, Rockhampton, and Peak Downs. He further referred them to the subgenus *Eupalæmon,* suggested they might be the young of the *Palæmon* n. sp. of de Man (1887),[2] and at the end of a comparative description proposed the name "*P. australis* n. sp." in the event of certain characters proving to be constant.

As early as 1910 my predecessor, the late Allan R. McCulloch, submitted several specimens from the above described series to Dr. J. G. de Man. This eminent authority's letter of reply, dated 21st

[1] *Cf.* Roux, Records Austr. Mus., xv, 3, 1926, p. 239.
[2] de Man.—Zool. Jahrb., Syst ii, 1887, p 711, f 4.

March, 1910, contains the following interesting and instructive remarks:—

In my opinion this species belongs to that which has been described by Dr. Ortmann, and for which he has created the name of *P. australis*. . . . I have taken the trouble to look over all the Indo-Pacific species of *Palæmon*; in my opinion your species is different from all, except *P. australis*, that has not yet been figured. It is a quite interesting species, related to *Pal. javanicus*, Heller, and that apparently ought to be referred to the subgenus *Parapalæmon*; Ortmann's specimens, that were young, did not yet distinctly show the characters of this subgenus and therefore were still referred by him to the subg. *Eupalæmon*.

Upon my demand Prof. Ehlers of Göttingen was so kind to send me the specimen from Sydney, described by me [see footnote [2]] to compare it with your specimens. This specimen now appears to me to *differ* from your specimens of *Pal. australis* collected near Bingara, N. S. Wales. The rostrum figured by me may be abnormal, though it cannot be proved with certainty before more specimens belonging to the same species will have been discovered: the habitat "Sydney" may also be false, but, of course, this is only a supposition.[3] This specimen differs, however, from your specimens by the *more slender shape of the thoracic legs, as also of the caudal fan.* The carapace is 22 mm. long from the orbital margin (exclusive therefore of the rostrum) until to the posterior margin. That of the largest of your specimens, also a male, is 23½ mm. In the "Sydney" specimen the telson is 12 mm. long, and 3⅜ mm. wide at base; in your male, long 23½ mm., the telson is 10½ mm. long and 4 mm. wide at base, presenting a less slender form. The endopodite of the caudal fan in the "Sydney" male is 12 mm. long and 4·3 mm. broad: appears in your male 11 mm. long and 4·75 mm. broad. In the "Sydney" male the merus and the carpus of the larger 2nd leg are 24 mm. resp. 27½ mm. long, the merus 4 mm. thick near distal extremity, the carpus 4·2 mm. In the larger leg of your male the merus and the carpus are each 20 mm. long,* the merus 4·75 mm. thick at apex, the carpus as much. These numbers prove the *more slender* form in the "Sydney" specimen.

The meropodite and propodite of the 3rd legs are in the "Sydney" male 13½ mm. resp. 12 mm. long, the meropodite 1·5 mm. thick, and the propodite 0·8 mm. broad in the middle. In your male from Bingara the meropodite of the 3rd legs is 10½ mm. long and 1·45 mm. thick, the propodite 9½ mm. and 0·85 mm. broad: as in the first legs, these numbers also show the stouter shape of the legs in your specimens. In your letter you called attention to the considerable amount of variation shown by your specimens. You ought now to examine whether they show also so great a variation as regards the proportion between the length and thickness or width of the joints of the thoracic legs as the difference in these proportions existing between your male from Bingara and the "Sydney" male from the Göttingen Museum. The *more slender* form of the thoracic legs† and of the caudal fan in the "Sydney" male is so striking that I am inclined to regard it as a species different from *P. australis*, and I can hardly believe that the variability of the latter should be so great that the "Sydney" species might be regarded as a variety of *australis*.

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[3] There is every reason for the doubt expressed by de Man The writer has had some experience collecting in the freshwater streams in and around Sydney and has never discovered any examples of *Palæmon*. In fact, it is justifiable to believe that they do not occur anywhere near Sydney. There are certainly no specimens of *Palæmon* from the vicinity of Sydney in the collection of the Australian Museum.

* "In *P. australis* the merus is as long as the carpus; in the 'Sydney' male shorter than the carpus."

† The thoracic legs are comparatively also longer in the Göttingen male, the body being slightly shorter; the carapace 22 mm. long, in your male 23·5 mm.

Family ATYIDÆ.

ATYA *Leach.*

ATYA STRIOLATA *McCulloch and McNeill.*

Atya striolata McCulloch and McNeill, Rec. Austr. Mus., xiv, 1, 1923, p. 55, pl. ix, figs. 3-4; and pl. x, fig. 3 (*Type locality.*—Nepean R., N. S. Wales). *Id.*, Roux, *loc. cit.*, xv, 3, 1926, p. 253.

A batch of ten specimens of this species has been acquired by the Australian Museum, establishing an additional and interesting locality for the species in the freshwaters of New South Wales. The specimens measure from 24 to 41 mm. in length (tip of rostrum to end of telson). Two of the three largest examples are egg-bearing females.

The species has previously been recognised from only one locality additional to that of the types; this was in a different watershed, but not greatly removed from the type locality. The present record suggests a very much wider distribution of the species, which was originally thought to be of rare occurrence.

Great interest must naturally be attached to any new data concerning the genus *Atya* in Australia, as the species in question forms the only authentic record from this large southern continent.

Species previously recorded from New South Wales.—Norton's Basin, Nepean River (Type Locality). Upper reaches of Woronora River (freshwater), flowing into George's River, near Sydney.

Additional locality.—In Myall River, near Gloucester, north from Newcastle, New South Wales, Dec., 1926. Collected by Miss L. M. Woods, B.A., School of Zoology, University of Sydney.

PANULIRUS (Gray-MS.) White.

PANULIRUS JAPONICUS (*von Siebold*).

Palinurus japonicus von Siebold, Spicilegia Faunæ Japonicæ, 1824, p. 15. *Id.*, de Haan, *in* Siebold's Fauna Japonica, Crust. 5, 1841, p. 158, pls. xli and xlii.

Panulirus japonicus Rathbun, Bull. U.S. Fish. Comm. xxiii, 3, 1903 (1906), p. 897, pl. v (with synonymy). *Id.*, Balss, Abhandl. d. math.-phys. Klasse d. k. bayer. Akad. d. Wissensch., Suppl. Bd. II, Abhand. 10, 1914, p. 77. *Id.*, de Man, "Siboga" Expd., Monogr. xxxixa^2, Decapoda pt. iii, 1916, p. 44. *Id.*, Parisi, Atti della Soc. Ital. d. Sci. Nat. lvi, 1917, p. 8.

A recent acquisition at the Australian Museum is a fine adult female example of the above species, which agrees perfectly with de Haan's figure, even to the longitudinal white lines on the ambu-

latory limbs; this latter feature is apparently not fully developed in Rathbun's smaller and light coloured example from the Hawaiian Islands (*fide* fig., 1906).

The species is evidently subject to considerable colour variation, being lighter or darker in individuals from the same locality, but the general colour scheme appears to be the same.

The present specimen measures 371 mm. (approx. 15 inches) from the tips of the rostral spines to the end of the telson. It is a dark variety of the species, and is medium-toned to dark purple-red in places on the carapace and dorsum of the abdomen, merging into an almost black hue on the legs, pleura of the abdominal somites, and the bases of many of the larger spines on the carapace. The characteristic flecks of white are scattered over the carapace, bases of the antennæ and antennules, and pleura of the abdominal somites.

Panulirus japonicus is known from many Indo-Pacific localities between Mauritius and the Hawaiian Islands, but the present record is the first from Australian waters.

Locality.—Three miles east of Evans Head, on coast near Ballina, Richmond River, northern New South Wales; secured by fishermen in a "lobster" pot. The specimen was received in a fresh condition from the State Fisheries Branch, Chief Secretary's Department, New South Wales, in December, 1926.

Family PORTUNIDÆ.

Genus CHARYBDIS *de Haan.*

CHARYBDIS CRUCIATA (*Herbst*).

(Plate xxxvii, fig. 5.)

Cancer cruciatus Herbst., Naturg. d. Krabben u. Krebse, ii, Heft 5, 1794, p. 155, pl. xxxviii, fig. 2.

Portunus crucifer Fabricius, Ent. Syst. Suppl., 1798, p. 364.

Charybdis crucifera Tozzetti, Bull. Soc. Entom. Italiana, iv, Firenze, 1872, p. 392.

Goniosoma crucifera Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 228 (record only). *Id.*, Ogilby, Edible Fish and Crust. N. S. Wales, 1893, p. 204.

Goniosoma cruciferum Ortmann, Zool. Jahrb., Syst., vii, 1893, p. 81.

Charybdis (*Goniosoma*) *crucifera* Alcock, Journ. Asiat. Soc. Bengal (n. ser.), lxviii, pt. 2, No. 1, 1899, pp. 49 and 51 (references).

Charybdis cruciatus Stead, Zoologist (4), ii, 1898, p. 204. *Id.*, Stebbing, Crust. South Africa, ii, 1902, p. 9 (synonymy and references).

Charybdis cruciata Rathbun, Bull. U. S. Fish. Comm., xxiii, 3, 1903 (1906), p. 872. *Ibid.*, in Stimpson, Smithson. Miscell. Colls., xlix, No. 1717, 1907, p. 80 (references).

Charybdis (*Goniosoma*) *cruciata* Delsman and de Man, Treubia, vi, livr. 3-4, 1925, pp. 308, 311, 316, pl. xii, *b*.

Charybdis crucifera Balss, Archiv für Naturg., 88 Jahrg., Abt. A, 11 Heft, 1922, p. 104.

An effort is here made to assemble in chronological order an account of the various references in literature to *C. cruciata*. With the exception of original references, repetition has been avoided, as several of the authors quoted have provided data which possibly cover the balance of literature on the species.

Early figures of *C. cruciata* are more or less crude, and most later illustrations depict only portions of the animal. The opportunity is therefore taken of submitting in this paper an excellent complete figure drawn by my colleague Mr. J. R. Kinghorn, which is the first to appear in Australian literature on the group. The original is a young female example from Kogarah Bay, in Botany Bay near the mouth of George's River, N. S. Wales; collected W. Davison, 1918 (carapace 43 mm. wide between the tips of the postero-lateral spines). Two large male and female specimens in the Australian Museum collection, from Port Jackson, N. S. Wales, measure respectively 139·5 mm. and 138 mm. between the tips of the postero-lateral spines.

Distribution.—The species occurs over a wide range in the Indian and eastern Pacific Oceans and the China Sea, and is usually an inhabitant of the shallow waters of bays and river estuaries. One or more examples are occasionally collected along the eastern coast of Australia.

In the writer's experience *C. cruciata* is rather uncommon in Port Jackson and the vicinity, and only very occasional specimens reach the Australian Museum. Ogilby noted in 1893 (*loc. cit.*) that the species "sometimes occurs in the markets in considerable numbers," but apparently the local numerical strength has diminished since then.

Family GONEPLACIDÆ.

Genus CARCINOPLAX *H. M. Edw.*

CARCINOPLAX MERIDIONALIS *Rathbun.*

Carcinoplax meridionalis Rathbun, Biol. Res. F.I.S. "Endeavour," v, 3, 1923, p. 99, pl. xviii (*Type locality.*—Off Rame Hd., Victoria, 76 faths.).

Pilumnoplax abyssicola Whitelegge, Mem. Austr. Mem., iv, 2, 1900, p. 158 (*nec* Miers, 1886).

A careful comparison of the holotype of this species with the specimens in the Australian Museum identified by Whitelegge from off Botany Bay, New South Wales, in 50-52 fathoms as *P. abyssicola* proves beyond doubt that they are referable to one and the same species. *P. abyssicola* must, therefore, be erased from the Australian faunal list, and *C. meridionalis* recorded for the first time from New South Wales waters.

Whitelegge's six specimens are all juvenile, measuring only 5 to 7·5 mm. between the tips of the lateral spines, thus being considerably smaller than Rathbun's holotype of *C. meridionalis* (width between tips of lateral spines 30·2 mm.). This probably partially accounts for the fact that the specimens were not recognized as representing a new species.

Since *C. meridionalis* was described a considerable number of specimens has come to hand from off the coast of New South Wales through the activities of the recently established trawling industry. Nearly all of these considerably extend the range of *C. meridionalis* northward along the eastern Australian coastline, and the localities are additional to those supplied by Rathbun in 1923. Apart then from Whitelegge's earlier record, there are specimens (mainly collected by members of the staff) in the Australian Museum from—

3 to 4 miles off Eden, 25 to 30 faths.; 5 specimens.
12 to 22 miles N. ½ E. from Green Cape, 39 to 46 faths.; 18 specimens.
About E. of Ulladulla (lat. 35° 20′ S., long. 150° 47′ E.), 74 faths.; 1 specimen.
E. of Ulladulla, 65 to 70 faths.; 1925; 1 specimen.
10 to 20 miles S. of Montague Id., 30 to 40 faths.; 1 specimen.
24 miles N.N.E. of Montague Id., 80 to 90 faths.; 1 specimen.
Off Botany Bay, 33 to 56 faths.; 3 specimens.
About 16 to 18 miles N.E. of entrance to Port Jackson, 15 miles from coast (approx. lat. 33° 44′ S., long. 151° 38′ E.), 75 to 80 faths.; 1 specimen.

Genus SPEOCARCINUS *Stimpson.*

Stimpson, Ann. Lyc. Nat. Hist. New York, vii, 1859, p. 58 (type.—*S. carolinensis* Stimp.); Rathbun, Bull. U.S. Nat. Mus., 97, 1917, p. 38.

The species described below agrees very well with the diagnosis of *Speocarcinus* given by Rathbun (*tom. cit.*), and it has not been thought necessary to erect a new genus for the accommodation of this newly recognised Australian form. The few minor points of

difference between the characters of the unique Australian representative of the genus and Rathbun's generic diagnosis are as follows:—

The fronto-orbital width is less than "three-fifths" of the "entire width" of the carapace, but is more than half.

Antero-lateral margins only very obscurely indented, with teeth obsolete, and not "dentate," with "teeth small."

Maxillipeds are "gaping," but only slightly so between the borders of the ischial joints when closed.

Meral joints of the maxillipeds not "as long as broad," but slightly broader than long; their antero-lateral angles, however, are prominent.

"Third to fifth segments" of the male abdomen appear not to be "more or less fused."

Up to the present time the members of the genus *Speocarcinus* have been recorded only from the Atlantic and Pacific coasts of the American continent, and four species have been described from this area (*fide* Rathbun, *tom. cit.*).

My thanks are due to Dr. Mary Rathbun for drawing attention to the fact that the Australian form was new to science, and to Mr. G. P. Whitley of the Australian Museum for the excellent line drawings which appear in the text.

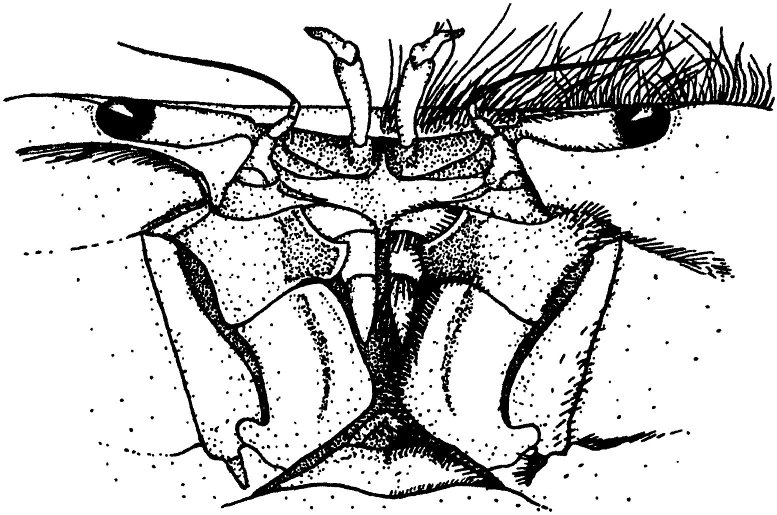
Two photographs prepared at Dr. Rathbun's instigation, when she had two examples of the new species on loan, are published in the present paper.

SPEOCARCINUS LUTEUS *sp. nov.*[4]

(Plate xxxvi and Figures 1-4.)

Description.—Carapace nearly smooth, sparsely pitted and obscurely granular or ridged near the margins. A broad shallow groove on each side of the cardiac region is distinct, but the other inter-regional grooves are indefinite. Margins of carapace and limbs with fringes of hairs; scattered but often well defined hairs may also occur over the carapace. Length 15 mm.; breadth 21 mm.; fronto-orbital width 11·3 mm. Antero-lateral borders thin, cristate, and entire except for two almost obsolete and ill-defined indentations. They are confluent with the postero-lateral borders, which are parallel, or nearly so. Front deflexed, the edge sinuous, and with a shallow median notch. It is less than one-fourth the width of the carapace, and the rather indefinite lobes are confluent with

[4] In allusion to the mud-living habits of the species



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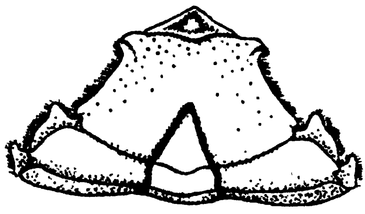

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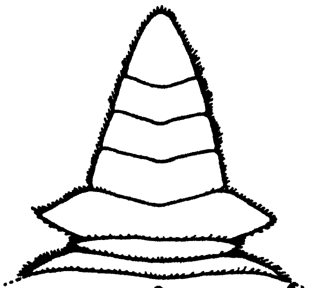

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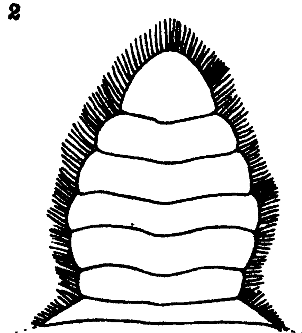

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Figures 1-4. ***Speocarcinus luteus*, n. sp.**
Fig. 1. Holotype; frontal view, half denuded. Fig. 2. Holotype; ventral portions of sternum and abdomen. Fig. 3. Abdomen of male, holotype. Fig. 4. Abdomen of female, paratype.

the outer angles, which again are not distinct from the inner orbital angles.

Eyes partly visible from a strict dorsal view, cone-shaped and thick; cornea small. Upper orbital margin smooth to the naked eye, a minute granulation being visible only with the aid of a powerful binocular microscope; no fissures present, and the outer angle not produced. Inferior orbital margin somewhat similar to the upper, again without fissures, and with the inner angle next the hiatus rounded and a little produced.

Outer maxillipeds slightly gaping between their inner ischial borders when closed, and with their component joints conspicuously furrowed externally. Greatest length of the merus about as long as ischium. Merus not quite as long as broad, its antero-external angle produced and rounded. Sternum broad, its greatest width not quite equal to the breadth of the carapace.

Chelipeds subequal; meral joints angular; margins granular, the upper one produced into a well defined tooth on its distal half. Wrists smooth externally, granular only near the distal edges, with the inner angle produced and sub-acute. Hand almost smooth, except for some granules above and at the lower basal angle. Movable finger granular above near the base. Immovable finger bent slightly downwards below the lower border of the palm. Both fingers with several large irregularly shaped and spaced teeth; they gape at their bases, but meet along the rest of their length, and the tips are recurved and overlap when closed.[5] Immovable finger nearly as long as the upper border of the palm.

Ambulatory legs unarmed, smooth and dorso-ventrally depressed; the third pair is the longest. The dactyli of the first three pairs of legs are long, slender and styliform; those of the last pair of legs shorter and curved upwards.

Colour.—Live specimens and those freshly preserved in alcohol are of a general rusty colour, with portions of the carapace and outer surfaces of the chelipeds lighter, and tending towards a creamish shade.

Description and figures based on an adult male example, which has been selected as the holotype of the species It was dredged from a muddy bottom in six fathoms, Salamander Bay, Port Stephens, New South Wales, by the late Allan R. McCulloch on 24th Sept., 1919. The holotype, together with three paratypes (one female 11 mm. wide and two males 16 and 20 mm. wide) collected at the same time, is stored in the collection of the Australian Museum (Regd. No. P.4489).

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[5] The male holotype is more or less senile, and unfortunately the tips of two of the fingers are mutilated

Sexual Dimorphism.—Adult females differ from the male holotype in having the chelipeds and limbs more hirsute. The chelipeds are less massive, and are practically equal in size. On the lower border of each palm there is a strong raised granular ridge, with traces of some rows of granules above on the proximal half. The grooves on the outer surfaces of the fingers are conspicuous and deep. Large regular teeth occur on the cutting edges of the fingers, those of the immovable fingers being clearly the largest, and the opposing sets meet neatly when the fingers are closed.

One juvenile male before me (carapace 11 mm. wide) has hands which agree in character with those of adult females, except that there is no trace of granules on the proximal half of the outer palm.

Additional material.—Besides the type series, there are other New South Wales examples in the Australian Museum from—

Port Stephens, dredged Jan., 1920; one female.
Off Sandy Point, Broken Bay, dredged 12 fathoms, mud ooze; Jan., 1926; one male.
Port Jackson; Old Collection; two females.

Genus MERTONIA *Laurie.*

Report Govt. Ceylon, Pearl Oyster Fisheries of Gulf of Manaar, part v, 1906, Brachyura, p. 423 (*type.*—*M. lanka* Laurie); and Tesch. Rés. "Siboga" Exped., Monogr. xxxix c[1], Brachyura II, p. 217.

The genus *Mertonia* is here recognised for the first time from Australian waters, being proposed as the proper generic name for Haswell's species *"Pilumnus integer."* A careful examination of Haswell's unique type proves that the species agrees well with the diagnosis given by Laurie and later supplemented by Tesch. It is the second known member of the genus, and there is no reason to doubt that it is now correctly placed, despite the fact that the characteristic flagella of the antennæ have become detached and are missing from Haswell's dried type specimen in the Australian Museum.

MERTONIA INTEGRA (*Haswell*).

(Plate xxxvii, figs. 1-4.)

Pilumnus integer Haswell, Proc. Linn. Soc. N. S. Wales, vi, 1881, p. 545; and Cat. Austr. Crust., 1882, p. 325. *Id.*, Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 227. *Id.*, Miers, "Challenger" Zool., xvii, 1886, Brachyura, p. 149.

Chasmocarcinus? intéger Rathbun, Biol. Res. F.I.S. "Endeavour," v, 3, 1923, p. 111.

Description.—Margins of carapace and limbs fringed with fine hairs; these are longest on the limbs and sparse on the carapace. Dorsal surface of carapace bare except for a patch of close, short, matted hairs near the anterior borders. When denuded the whole surface of the carapace is finely granular and minutely wrinkled. From a direct dorsal view the outline is roughly semicircular.[6] It is strongly convex longitudinally, being very much more deflexed in front than behind; from side to side the carapace is flat. It is widest posteriorly, with the border strongly curved, and a distinct groove traverses the length of the border just inside the margin, giving it a raised appearance. Postero-lateral borders confluent with the antero-lateral, and entire, both converging rapidly towards the narrow front. A groove extends back from the well-marked frontal notch, and a distinct one is present on each side of the cardiac region. Other regional grooves more or less indefinite. First two segments of the abdomen and sternum visible from a dorsal view. Length of carapace 6·5 mm.; breadth between posterior borders 8·5 mm.; fronto-orbital width 4·5 mm.; widest part of sternum 8 mm. Front strongly deflexed, its edge produced into two distinct rounded lobes, which are confluent with the outer angles; the latter are not distinct from the inner orbital angles.

Eyes barely visible from a direct dorsal view, small, thick; they have angular frontal edges; the dorsal surfaces are flat, microscopically granular, and on the same plane as the carapace. Orbital borders entire, the upper ones sparsely clothed with microscopic granules, and with their external angles not produced; lower orbital borders smooth, with their inner angles rounded and receding.

Outer maxillipeds gaping, oblique. Merus a little broader than long, shorter than the ischium, and with its antero-lateral angle produced. Ischium with a median furrow externally. Distal halves of the basal joints of the antennæ situated in the orbital hiatuses, but the characteristic flagella have been lost through damage.

Chelipeds apparently moderately unequal. Wrist nearly smooth, obscurely granular near the anterior margins, and with its inner angle produced. Larger hand granular above on and near the border and around the base. There is also a raised granular ridge along the lower margin, which traverses the length of the movable finger. Inside of this is a groove which becomes more defined distally, and is deepest just beyond the base of the movable finger. Remainder of the outer surface of the hand smooth. Movable finger of the large hand with a few granules near the base, its length being about equal to that of the palm. The fingers do not quite meet along their length when closed, but the tips overlap.

[6] In the figure appearing in this paper the anterior portion of the carapace is illustrated as being a little more advanced than can be seen in a strict dorsal view.

The cutting edges bear well developed teeth, those of the immovable finger being the largest.

Ambulatory legs unarmed, smooth. The dactyli which remain intact are thin, elongate, and recurved at their tips.

Colour.—The single dried example is brown above, lighter on the limbs, and creamish on the sternum and abdomen. Hand of the large cheliped whitish externally.

Described from the dried male holotype of the species, which is recorded by Haswell as having been dredged in Port Jackson, New South Wales, and is the only specimen known. It is considerably damaged, and its imperfections can be gleaned from the figure. It will be noticed particularly that the smaller hand is now missing from the holotype. Haswell describes this in the following extract: "granular over all the outer surface with the exception of a triangular space near the base of the mobile finger, the former only granular near the base, a granular ridge near the lower border of the propoda of both chelipedes, becoming entire on the digital portion to the apex of which it extends."

Discussion.—Miers (1886, *tom. cit.*) was the first author to observe that Haswell's "*P. integer*" could not be retained in the genus *Pilumnus*. The question then lapsed until taken up by Dr. Mary Rathbun prior to the publication of her paper in 1923 (*tom. cit.*), when she reviewed all the Australian species described in the genus *Pilumnus*. In her published paper she stated that the above species of Haswell's "should be referred to *Chasmocarcinus* or a kindred genus." This decision, like that of Miers, was based only on a study of Haswell's original descriptions of "*P. integer*." Later a drawing of the holotype of "*P. integer*" was prepared at the Australian Museum and forwarded to Dr. Rathbun for her further information. With this supplementary knowledge she then suggested either the genus *Mertonia*, or *Xenophthalmodes* Richters, as being more correct receptacles for "*P. integer*." The present study of the species is the outcome of Dr. Rathbun's kindly guidance.

EXPLANATION OF PLATE XXX.

Fig. 1. *Congrogadus subducens* (Richardson). A specimen from Darwin, North Australia.

Fig. 2. *Pictilabrus laticlavius* (Richardson). A specimen from Long Bay, New South Wales.

Fig. 3. *Ellerkeldia maccullochi* Whitley. A specimen from Rose Bay, New South Wales.

Fig. 4. *Cepola australis* Ogilby. A specimen from Port Jackson, New South Wales.


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EXPLANATION OF PLATE XXXI.

Fig. 1. *Upeneus signatus* Günther. A specimen from Elizabeth Bay, Port Jackson, New South Wales.

Fig. 2. *Upeneichthys porosus* (Cuvier and Valenciennes). A specimen from Elizabeth Bay, Port Jackson, New South Wales.

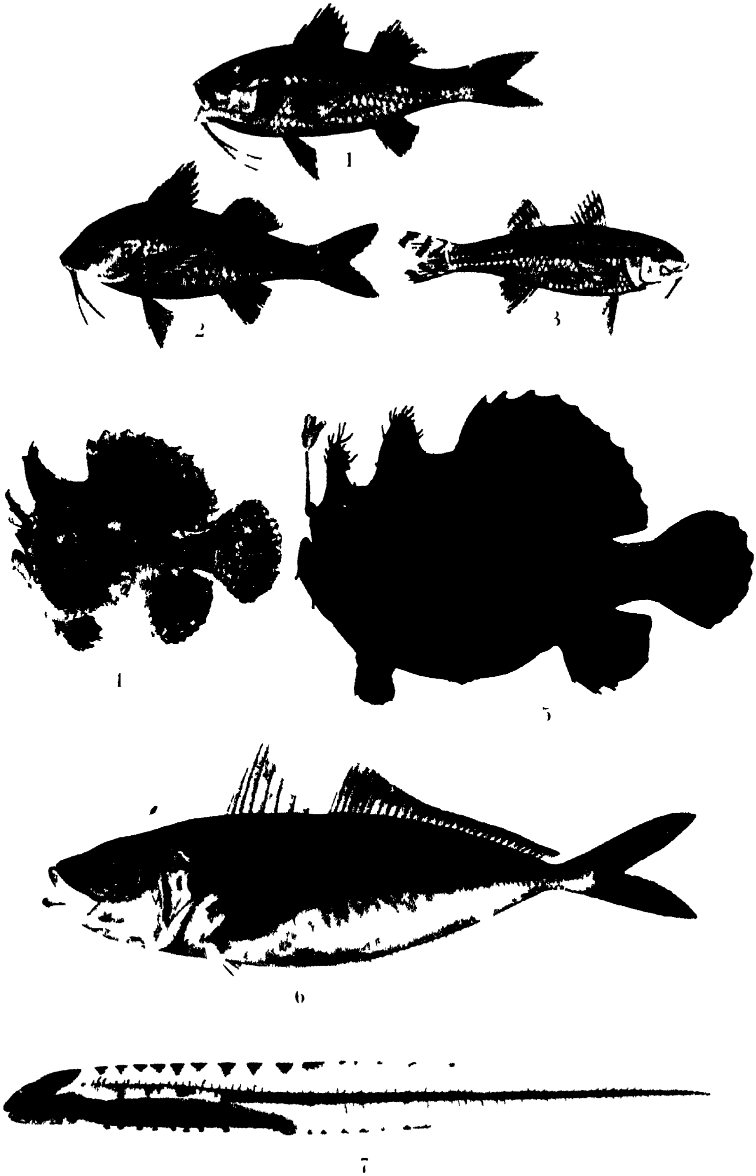
Fig. 3. *Upeneoides jeffi* (Ogilby). A specimen from Elizabeth Bay, Port Jackson, New South Wales.

Fig. 4. *Pterophrynoides histrio* (Linnæus). A specimen from New South Wales.

Fig. 5. *Antennarius commersonii* (Cuvier). A specimen from Watson's Bay, Port Jackson, New South Wales.

Fig. 6. *Trachurus declivis* (Jenyns). A specimen from Port Jackson, New South Wales.

Fig. 7. *Alabes parvulus* (McCulloch). A specimen from Coogee, New South Wales.

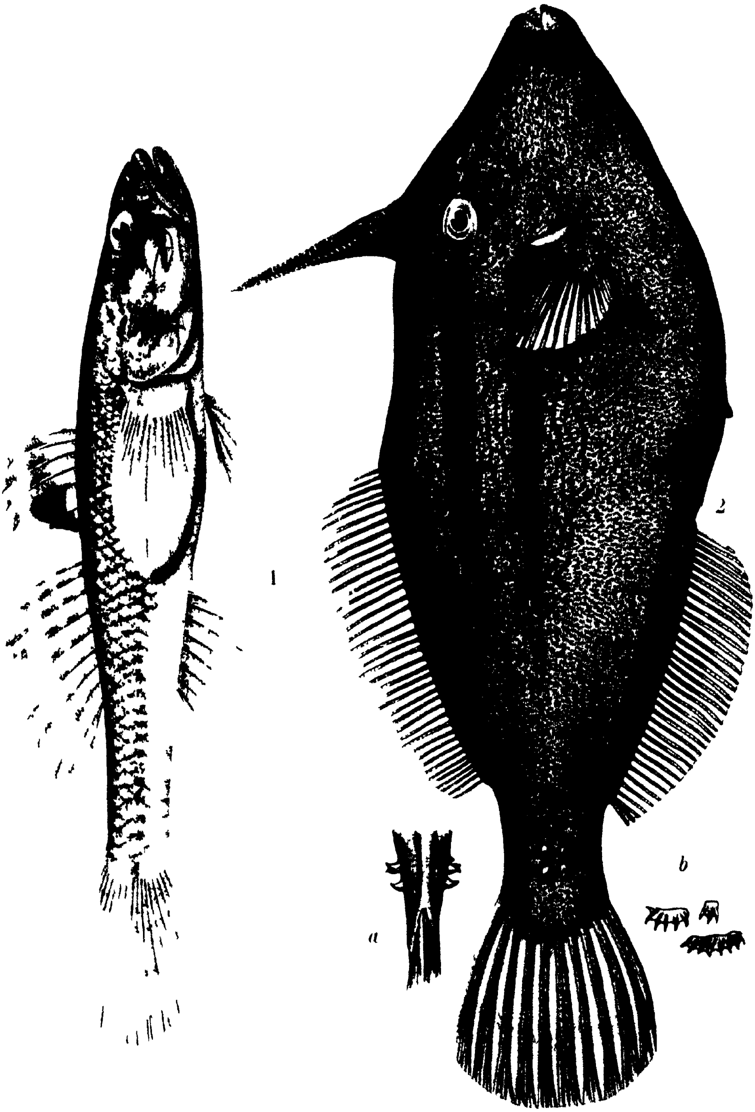


Allan R. McCulloch, pinx.

EXPLANATION OF PLATE XXXII.

Fig. 1. *Glossogobius vomer* Whitley. A specimen from Swan River, Western Australia.

Fig. 2. *Meuschenia trachylepis* (Günther). A specimen from Maroubra, New South Wales. *a*. Caudal spines from dorsal aspect; *b*. two bodyscales and one smaller scale from the tail, magnified.



Allan R. McCulloch, del. (1).
Frank A. McNeill and Gilbert P. Whitley, del. (2).

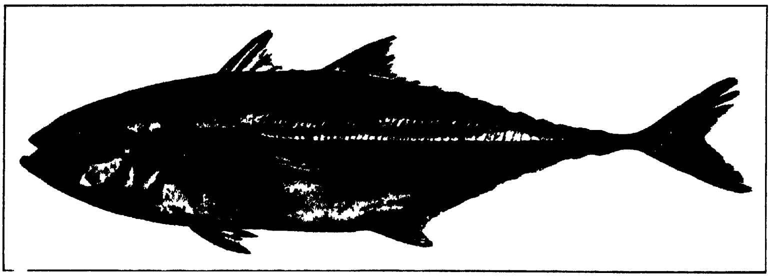
EXPLANATION OF PLATE XXXIII.

Fig. 1. *Megalaspis cordyla* (Linnæus). A specimen from Port Jackson, New South Wales.

Fig. 2. *Rexea solandri* (Cuvier and Valenciennes). Holotype of *Thyrsites micropus* McCoy from Tasmania.

Fig. 3. *Chœrodon monostigma* Ogilby. Cotype from Pine Peak, Queensland.

Fig. 4. *Chœrodon ambiguus* Ogilby. Cotype from off Double Island Point, Queensland.



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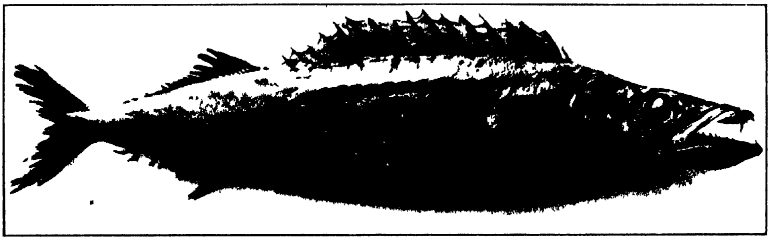

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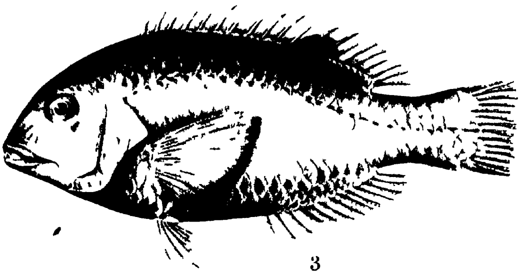

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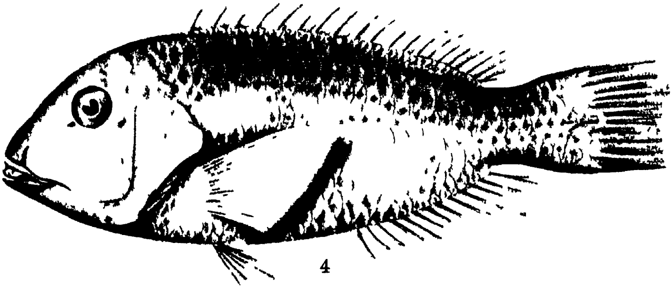

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David G. Stead, photo. (1).

EXPLANATION OF PLATE XXXIV.

Fig. 1. *Amphiprion mccullochi* Whitley. Holotype from Lord Howe Island.

Fig. 2. *Parma mccullochi* Whitley. Holotype from Rottnest Island, Western Australia.

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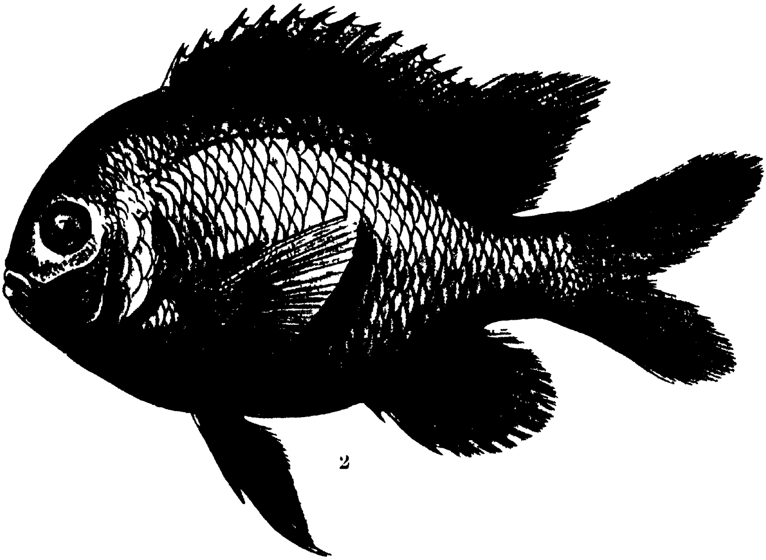


2

Joyce K. Allan, del.

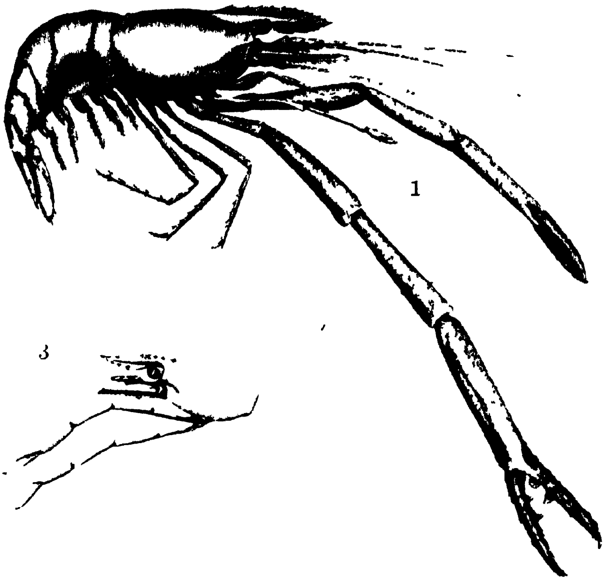
EXPLANATION OF PLATE XXXV.

Palæmon (Parapalæmon) australis (Ortmann).

Fig. 1. Adult male specimen from Pallal, Horton River near Bingara, N. S. Wales (natural size).

Fig. 2. Adult female specimen from same locality (natural size).

Fig. 3. Juvenile specimen from same locality (about 1½ times natural size).



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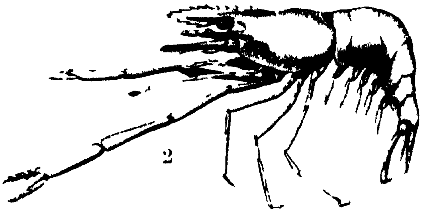


2

Allan R. McCulloch and
Frank A. McNeill, del.

EXPLANATION OF PLATE XXXVI.

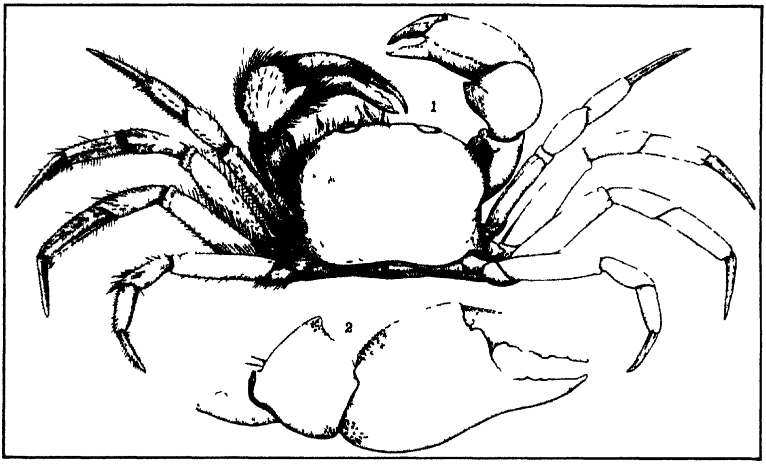
Speocarcinus luteus sp. nov.

Fig. 1. Male holotype (half denuded). Carapace 21 mm. wide.

Fig. 2. Wrist and hand of right cheliped of same (enlarged).

Fig. 3. Dorsal view of incomplete male paratype. Carapace 20 mm. wide.

Fig. 4. Ventral view of same.



Gilbert P. Whitley and
Frank A. McNeill, del. (1 2).

C. R. Shoemaker, photo. (3 4).

EXPLANATION OF PLATE XXXVII.

Mertonia integra (Haswell).

Fig. 1. Male holotype (damaged). Carapace 8·5 mm. wide.

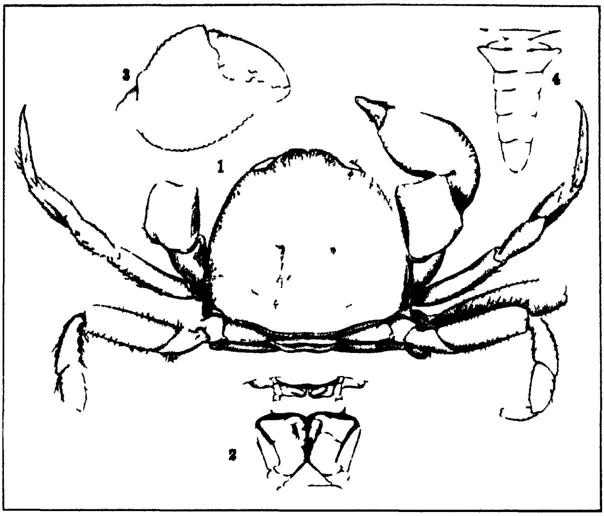
Fig. 2. Ventral view of same to show maxillipeds, epistome, etc.

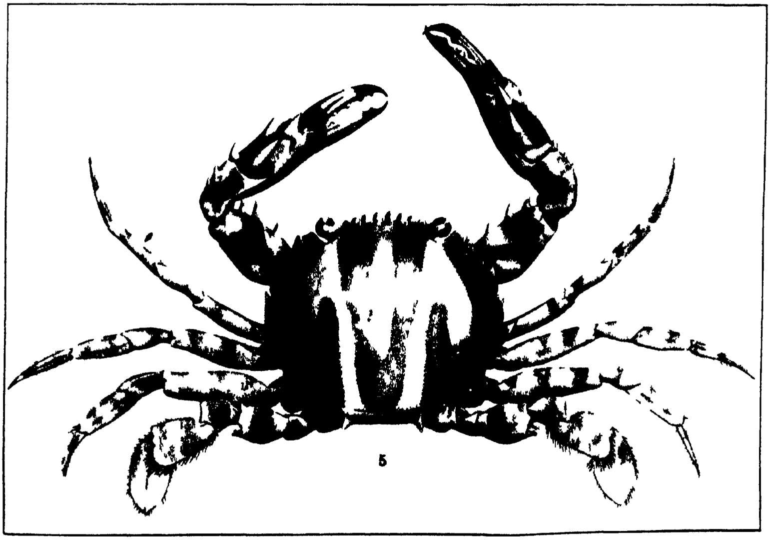
Fig. 3. Right or major hand of same.

Fig. 4. Abdomen of same.

Charybdis cruciata (Herbst).

Fig. 5. Young female specimen from Kogarah Bay, in Botany Bay, N. S. Wales. Carapace 43 mm. wide between the tips of the postero-lateral spines.





Allan R. McCulloch and F. A. McNeill, del. (1-4).
J. R. Kinghorn, del. (5).

MOLLUSCA FROM THE CONTINENTAL SHELF OF EASTERN AUSTRALIA.

No. 2.

By

Tom Iredale,

Conchologist, The Australian Museum.

(Plates xxxviii-xli.)

In continuation of a paper published under the above title in these Records[1] I offer descriptions of some more interesting forms.

Since the former paper was published little addition was made to our knowledge until quite recently, but now an old shell collector from Scotland in the person of Mr. Herbert Howell, well known in the annals of the molluscan history of Great Britain through his activities in securing rare specimens while engaged in the trawling industry off Aberdeen, has joined the trawling industry here. His interest was revived by the novelty of our fauna, and he has already made a very valuable addition to the larger faunula, and we can anticipate still more striking finds in the future; all of the species here discussed have been brought in by him.

Probably many of the species here introduced will later be found to be closely related to the fossils of the Muddy Creek and Table Cape beds. It would be a delightful study to correlate the recent and fossil species of Australia, as Finlay and Marwick are doing in connection with Neozelanic forms. In the present paper the *Glycymeris*, *Conus*, *Xenotrophon* and *Mathildona*, all of novel aspect as regards the recent fauna, appear to represent fossil types, and their exact relationship might be ascertained were long series of the fossils available.

The beautiful illustrations accompanying this article have been prepared by Miss J. K. Allan, of this Museum, and my thanks are herewith tendered for the exact representations, which cannot be surpassed; the photographs have been taken by Mr. G. C. Clutton, also of this Museum, and again thanks must be offered for the skilful portraiture of these difficult subjects.

[1] Iredale.—Rec. Austr. Mus. xiv, 1925, pp. 243-270.

NUCULA OBLIQUA *Lamarck*.

A lumping policy was adopted by Hedley in connection with the species of *Nucula* similar to the common *N. obliqua*. Larger series show that valid distinctions exist according to locality and depth, and consequently two of the names regarded as synonymous can be revived. The deepwater form for which Smith provided the name *N. dilecta*[2] is easily separable on account of its shape and smaller size, while the fossil *N. tenisoni* Pritchard is a much larger, crass, and more elongate shell, also much less obese at the same size than the typical south Tasmanian shell, which has also much longer teeth. Comparison of series indicates that the South Australian form is easily distinguishable by its more prominent beaks, fewer teeth, steeper anterior side, and less arched posterior side, as compared with the deepwater New South Wales shells here called *dilecta*. A series dredged from 100 fathoms, 40 miles south of Cape Wiles, South Australia, is here named *Nucula obliqua subdilecta*, nov.

Family NUCULANIDÆ.

Under the generic name *Nuculana*, Hedley admitted very differently shaped forms, and in order to save time and gain accuracy it is proposed to name the groups determined. The type of *Nuculana* is a long-beaked Palæarctic species much more resembling our *Propeleda* than the shells grouped round *L. crassa* Hinds, for which I introduce the genus name *Scæoleda*.

The forms hitherto lumped under *crassa* can be separated into at least three, the typical south Tasmanian form being very large, while the New South Wales form differs in shape, and is always a smaller, less obese shell; this will bear the name *hanleyi* as already pointed out. The South Australian shells are also large, but differ in shape, having shorter beaks and being deeper, the juveniles being more closely sulcate. This can be named *Scæoleda crassa illepida* nov., the series being from Encounter Bay, South Australia.

Differing by the lack of the customary sculpture, the name *Teretileda* is proposed for *N. oculata*, and with it may be classed *N. fortis*, the very long narrow teeth and small deep set chondrophore being peculiar. *Leda inopinata* is a curious and distinct shell as pointed out by its conservative author, E. A. Smith, and is therefore distinguished as *Magaleda*.

L. ramsayi is also unhappily situated, and would be better transferred to the neighbourhood of *Propeleda*, though its sculpture seems to indicate separation from that group as *Thestyleda*. Before leaving the family attention may be drawn to the fact that the South Australian deepwater shells differ at sight from the New

[2] Smith.—Proc. Zool. Soc., 1891, p. 443, pl xxxv, f 25

South Wales representatives. Thus *Comitileda miliacea* is common in our dredgings, and the South Australian shell so named differs in being larger, with a more lengthened beak and also shorter anterior side. It may be that there is more than one species of this genus, the smaller one being *miliacea,* the larger one being called *remensa* nov. May has named a fossil *Nuculana rhomboidea*[3] without drawing attention to its very close relationship with this species.

Hedley's *Leda pala*[4] may be at present included in *Comitileda,* as the species *remensa,* the type locality being 100 fathoms, 40 miles south of Cape Wiles, South Australia, appears to have been regarded by Verco as *pala,* from which it differs in size and shape as well as hinge formation.

Dredged in 40 fathoms north of Cape Borda, South Australia, is a species of *Poroleda* which differs from *spathula* in the presence of a fine radial sculpture, and is here named *flindersi.* Apparently a similar shell lives in deeper water off the eastern coast, and these will be further dealt with later.

MICROCUCULLÆA *gen. nov.*

This name is proposed for *Bathyarca perversidens* Hedley, which, as I have already pointed out, appears to be a dwarf relation of *Cucullæa.*

The South Australian form may be named *Microcucullæa adelaideana,* a necessary name as Verco[5] has suggested that it partook of the characters of the Peronian *perversidens,* while showing some of the Neozelanic *cybæa* and thereupon concluded that the whole three should be lumped, a retrograde step forbidden by the geographical distribution of the three forms.

Specimens from 100 fathoms, 40 miles south of Cape Wiles, South Australia, are smaller, much more globose, less inequilateral, and much more weakly sculptured than the typical *perversidens,* and are also more equilateral than *cybæa.* As pointed out by Verco, the right valve is more strongly sculptured, and is also smaller and clasped by the left valve.

LIMOPSIS LORINGI *Angas.*

A shell in general agreement with this species was brought in by Howell from 55-60 fathoms off Montague Island, and was noted to be much more oblique than the figure prepared from a Moreton Bay shell. Small Limopsid shells also occurred, and examination of

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[3] May.—Papers Proc. Roy. Soc. Tasm., 1921, p. 12, pl. iv, f. 9.
[4] Hedley.—Rec. Austr. Mus., vi, 1907, p. 36, pl. lxvi, f. 1.
[5] Verco.—Trans. Roy. Soc. South Austr., xxxi, 1907, p. 222.

the series showed many anomalies present on account of the scant material generally available. The differences seen in the various groups deserve recognition, so that *Loringella* is here proposed for the large species, *loringi* being named as type.

For the curious little group typified by *L. brazieri*, the name *Phrynelima* is introduced, the hinge line showing many closely packed teeth, upon which, medially, the external ligament pit intrudes.

A further development is seen in *L. erectus*, where the teeth are few and widely separated by the ligament pit, which is tending to become internal, and recalls the American fossil genus *Trinacria*; the generic name *Aspalima* is provided for this species, and the South Australian form may be differentiated as *Aspalima erecta idonea* subsp. nov., a series collected from 100 fathoms, 40 miles south of Cape Wiles, S.A., being larger, less strongly sculptured, comparatively broader, and with weaker teeth.

Under the name *Limopsis tenisoni* Tenison-Woods probably more than one species and many subspecies are being associated. The South Australian *penelevis*, which Verco introduced as a variety only, is worthy of full specific rank, while other specimens ranked under this name show diverse hinge formation.

Under the name *Glycymeris radians* there are in this Museum specimens of a large Limopsid shell from South Australia which appear to have been overlooked.

CYRILLONA *gen. nov.*

This name is proposed for the minute shell called *Cyrilla dalli* Hedley,[6] which was well figured. It is a common species among the sand brought up, and is certainly not congeneric with *Cyrilla* A. Adams,[7] whose type species, among other things, was sulcate.

Verco[8] has added *Nuculina* (*Cyrilla*) *concentrica* from 104 fathoms, 35 miles south-west of Neptune Island, South Australia. It was obvious from the figure that this was referable to a genus distinct from either *Nuculina* or *Cyrilla*, and it does not agree with Hedley's *C. dalli* in hinge formation. In order to avoid further confusion the new generic name *Cyrillista* is here proposed for Verco's species.

I cannot see any valid reason for including these shells in the family Arcidæ.

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[6] Hedley.—Austr. Mus. Mem., iv, 1902, p. 296, fig. 44.
[7] A. Adams.—Ann. Mag. Nat. Hist., (3), v, 1860, p. 478.
[8] Verco.—Trans. Roy. Soc. South Austr., xxxi, p. 220, pl. xxvii, figs. 4 *a*, *b*.

GLYCYMERIS MAGNIFICENS *sp. nov.*

(Plate xxxviii, figs. 1-2.)

Although dead and somewhat worn this magnificent shell adds another important item to our knowledge of the mollusca of the Continental Shelf, as obviously it is related to the fossils grouped about *G. maccoyi* Johnston, which have been exhaustively treated by Chapman and Singleton.[9]

Marwick[10] has also described the New Zealand recent and fossil forms, and these palæontologists' results are not easy to reconcile with a study of large series of recent species. There seems to be much individual variation as well as age differences, and when in addition we have geographical differentiation, and also bathymetrical divergence, the problems surrounding the recent forms are not easily solved. The conclusions put forward five years ago[11] have not been materially amended, though the variation has been found to be more extensive, and specimens suggesting new species have been separated, but until longer series are obtaind these will not be diagnosed.

The species now described is the largest Australian form, rivalling the magnificent Neozelanic *G. laticostata* in size. Howell has brought in two dead valves from 50-60 fathoms off Montague Island, New South Wales, and states that very dead shells are not uncommonly met with, but no good recent shell has yet been found, which is natural in view of the fact that the trawl can only pick up surface material.

Shell very large, solid, suborbicular, a little longer than wide, moderately convex, beaks incurved and approximate, ligamental area very large and steep. Hinge line nearly straight, rounded at sides; hinge teeth obliterated with age by the intrusion of the ligamental area, which is deeply carved with incised lines; in the younger shell two large rounded teeth can still be seen at each side. Margin markedly crenulate in agreement with external sculpture, though, curiously enough, this external ribbing has disappeared in the senile example. Muscle scars large, calcified, the posterior one elevated upon a flattened boss; the pallial line well marked. The external sculpture consists of about forty to fifty low rounded ribs with narrow interstices, which become evanescent at sides, and obsolete with age, strong concentric growth lines developing in their place. These ribs appear to be stronger, more elevated, and narrower on the posterior side.

The size of the larger specimen figured is 106 mm. in height, 97 in length and 35 in thickness, single valve; the smaller measures

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[9] Chapman and Singleton.—Proc. Roy. Soc. Vict., n.s. xxxvii, 1925, pp. 18-60.
[10] Marwick.—Trans. New Zeal. Inst., liv, 1923, pp. 63-80.
[11] Iredale.—Proc. Linn. Soc. N.S.W., xlix, 1924, pp. 187-9.

95 × 88 × 30 mm. Judging from the figures given by Chapman and Singleton this species is most like the fossil *G. ornithopetra,* but their fossil *"G. flabellatus,"* figure 30, from the Werrikooian appears quite distinct from the recent species. There is also confusion among the recent species in South Australia, as in addition to *G. sordidus* and *G. flabellatus,* which are certainly different species, there is another fine large species collected by Mr. A. Broadfoot at Whyalla, Spencer's Gulf, which I here name *Glycymeris broadfooti.* It is characterized by its shape, being much less circular than *flabellatus,* its fewer stronger ribs with deep narrow interstices, and its fewer, more closely set and more horizontal teeth, the ligamental area deeper and encroaching more on the hinge teeth. *G. sordida* Verco and *G. insignis* Pilsbry are both more triangular, with flattened ribs and more numerous teeth. Height of type (single valve), 47 mm.; length, 44 mm.; thickness, 16 mm.

MESOPEPLUM CAROLI *sp. nov.*

(Plate xxxviii, figs. 7-9.)

This name is proposed for the fine large scallop trawled in 40-80 fathoms off the New South Wales coast, which has been referred to *C. hedleyi.* I have shown that the latter name was proposed as a new name only for Hedley's *C. fenestrata,* and that the older name must be resumed. Hedley's species was based on a small shell taken in Port Jackson, and he regarded the fine shell trawled as the adult of his species. I find, however, that his small shell is adult, and differs in shape and solidity from the present form, which is therefore here named as above.

Hedley lumped all the *Chlamys*-like scallops under the one name, and it is confusing to find quite unlike forms, such as these, associated with the *asperrimus* series. I had collated a few items when a paper by Marwick[12] on this subject was received, and therefore some of my notes with relation to these southern forms are here included. The Palæarctic forms, both recent and fossil, have been referred to so many little groups that it would be a very unwise policy to attempt to allot our species to these northern groups merely from superficial features. European palæontologists, as well as malacologists, are not agreed, while Dall pointed out the difficulties when American fossil and recent species were studied.

Four very distinct series are at once noted, the *asperrimus, lividus, bifrons* and *"hedleyi"* groups, and it will clarify matters to designate these groups as genera, so I herewith propose *Mimachlamys* with *P. asperrimus* as type, *Scæochlamys* with *Pecten lividus* as type, *Equichlamys* with *P. bifrons* as type and *Mesopeplum* with *M. caroli* as type.

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[12] Marwick.—Trans New Zeal. Inst., lviii, 4, 1928, pp 445-456.

In *Mimachlamys* the valves are both convex, but the left valve is more convex than the right, the auricles are unequal, the posterior being much smaller than the anterior. The byssal gape is deep and very strong, pectinidial teeth are present, a deeply furrowed fasciole occurring. The sculpture consists of closely scaled numerous radials flanked with subsidiary more delicate riblets, a deep gutter intervening between each group, which becomes filled up with such riblets as maturity is reached. The prodissoconch is smooth, with concentric growth lines, the succeeding sculpture being plain riblets with scratched intervals, the scales developing later. The sculpture on the two valves does not differ appreciably in design. In *Scæochlamys* a somewhat different growth sequence can be traced the auricles being more unequal, but otherwise the immature is similar to that of the preceding. The sculpture begins with plain radials, ten to twelve on the left valve but twenty to thirty on the right valve. The interstices between the riblets are threaded radially with irregular scratches, but this interradial sculpture develops into the well-known "*Camptonectes*" form and then vanishes. On the valves the original ribbing develops in strength, but remains constant in number, scales appearing according to situation, and growing more strongly on the left valve, thus producing a dissimilar effect in the mature stage. The valves also become distorted with age, while the hinge area is more pronounced. *Equichlamys*, on the other hand, is a much larger flattened inequivalve form with the ears small and subequal, byssal gape small, almost missing, and pectinidial teeth almost obsolete in mature shells, though present in young specimens. Seven to nine distant compound ribs have their broad intervals filled with fine radials, the whole covered with "*Camptonectes*" sculpture. These large ribs are well marked internally, but, while with age the superficial ribs have a strong tendency to disappearance, the internal ridges become more pronounced, suggesting those of *Amusium*. The right valve is tightly clasped by the left, with the sides open, another Amusioid feature.

Mesopeplum caroli has the valves unequal, the right valve deeper than the left, auricles small and prickly, subequal, byssal gape minute, scarcely noticeable, pectinidial teeth small in the immature, obsolete in the adult. Left valve pink, right valve white.

Sculpture of the left valve: five prominent distant compound ribs, having the intervals broader than the ribs; the right valve has, similarly, five compound ribs whose intervals are narrower than the broad, flattened series whose edges fit into those of the left valve. The compound ribs of the left valve are composed of three ridges, rather sharp, the middle one the largest; the compound ribs of the right valve are made up of four to eight low, flattened semi-equal ribs, in early life scarcely separable but divergent with age. The interstices in the left valve have four to eight fine ridges, those of the right being deeper and with two or three ribs therein. Very fine

concentric threads over-run the whole of the left valve, but appear only in the intervals on the right valve, where, on the contrary, concentric growth lines are well marked continuously on the ribs. Height, 45 mm.; length, 48 mm.; thickness of conjoined valves, 21 mm. Type trawled in 55-60 fathoms off Montague Island, New South Wales.

Subordinate names must be proposed for the curious shell called *aktinos* by Petterd, and the deepwater forms as *famigerator* and *perillustris*. Thus *aktinos* recalled *Scæochlamys*, but has similar close radials on both valves, "*Camptonectes*" sculpture throughout and persistent, and the posterior auricle curiously folded in, so that at first sight it appears to have been broken off. The subgeneric name *Belchlamys* is proposed for this species alone.

The form *famigerator* seems to represent an arrested stage in the development of *Mimachlamys*, apparently never growing to a large size and being always less convex, with a more suppressed sculpture. It may be named *Talochlamys*, subgen. nov.

The very thin substance, obsolescence of sculpture, obliquity of shape, and delicacy of hinge characterize the deepwater species *perillustris* and *challengeri*, and for them the new subgeneric name *Veprichlamys* is introduced, the former being selected as type.

The minute shells, referred by Hedley to *Cyclopecten*, do not agree at all well with the type of the genus, differing in shape, sculpture, and hinge details, and must be classed in a new genus *Chlamydella*, the species *favus* being named as type.

While *Amusium* may be retained for *japonicum*, the species name may later be amended, but the small species *thetidis* is here made the type of the new genus *Ctenamusium*. Palæarctic palæontologists have proposed *Propeamusium*, *Parvamussium*, and *Variamussium* for similar forms but ours do not exactly agree. Thus while *Amusium* is very large and circular, with the ears small and subequal, the surface smooth, the shell gaping with no byssal gape, the chondrophore long and narrow, *Ctenamusium* is minute, ears large and unequal, surface sculptured, sculpture differing in each valve, valves unequal and clasping, byssal gape present, chondrophore small and broad. While the right valve has only concentric ridges, the left valve has radials at first, becoming cancellate with age.

The left valve figured by Hedley and Petterd[18] as of this species from 250-300 fathoms represents a different species, which is here named *Ctenamusium salacon*, the right valve being much more closely concentrically ridged, and the left valve of true *thetidis* is less strongly sculptured, and the internal ribbing differs.

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[18] Hedley and Petterd.—Rec. Austr. Mus., vi, 1906, pl xxxviii, figs. 18-19.

SPONDYLUS (TENELLUS) REGILLUS *sp. nov.*

(Plate xxxviii, figs. 3-5.)

When Howell brought in a magnificent specimen of this species he recounted its strange habit of living enveloped in a sponge. On this account it shows no point of attachment and its growth is comparatively free and regular. At first it was regarded as the deepwater representative of the littoral *S. tenellus* Reeve, but this is not definite.

Shell large, inequivalve, inequilateral, upper valve slightly convex, lower valve deeply convex, free, unattached; umbo of right valve very prominent. Sculpture on the two valves similar, about twenty primary ribs, with long well developed spines, which are generally well thrust forward. With age similar weaker ribs develop in the interstices, a very fine scaly radial sculpture persisting all over the shell.

Height, 83 mm.; length, 90 mm.; depth of conjoined valves, 45 mm. Trawled off Montague Island, New South Wales, 50-60 fathoms.

AUSTROLIMA *gen. nov.*

This name is proposed for *Lima nimbifer*, which has a very small enclosed animal, sedentary by means of a byssus. The South Australian form of *nimbifer* differs in being broader and shorter, and more obese, and may therefore be named *Austrolima nimbifer gemina* nov.

Numerous specimens trawled show that *L. benthonimbifer* is constantly smaller, and more regular as diagnosed, but comparison with South Australian shells dredged in 100 fathoms, 40 miles south of Cape Wiles, and determined by Hedley as conspecific with the fossil *bassi* compels their distinction with the name *Austrolima spectata* nov., an obvious character being the more abundant ribbing of the South Australian shell, the ribs numbering over forty, while there are only thirty-two on the eastern shell, and on a fossil from Table Cape, North Tasmania, there are only twenty four ribs, the type of *bassii* from that locality being described as having twenty-two ribs only.

ESCALIMA *gen. nov.*

This new generic name is introduced for the shell named *Limea acclinis* by Hedley,[14] dredged in 100 fathoms off Wollongong, New South Wales; he later recognised it as *Lima murrayi* of Smith[15] from 440 fathoms off Sydney.

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[14] Hedley.—Rec. Austr. Mus vi, 1905, p. 46, fig 10

[15] Smith.—Proc. Zool. Soc., 1891, p. 444, pl. xxxv, f 26

Prejudiced by the presence of teeth in the hingeline, Hedley preferred *Limea* to *Lima,* though recognising the superficial resemblance of his species to *Lima linguatula* Lamarck.

Its thin shell and otherwise great dissimilarity from the traditional *Limea* urged its transference from that genus, and it was referred back to *Lima,* where Smith had located it. It now becomes necessary to create a better receptacle, as the form is prevalent all round the southern coast of Australia as far as yet investigated.

Consequently the shallower form *acclinis* can be allowed as well as the deeper *murrayi,* as the latter specimens are smaller and comparatively broader, the two forms being recognised as *Escalima murrayi murrayi* Smith, and *Escalima murrayi acclinis* Hedley.

Specimens dredged from 100 fathoms off Cape Pillar, south Tasmania, may be named *Escalima murrayi maugeana* subsp. nov., as the shells are much deeper than *acclinis,* the hinge triangle much larger, the teeth less distinct and externally the ribs are fewer.

On the other hand shells dredged in 100 fathoms, 40 miles south of Cape Wiles, South Australia, while also deeper than *L. acclinis,* are not as deep as the preceding, but are broader and shorter, with the hinge teeth more pronounced and more numerous, while the sculpture is not so complex, concentric lining and radials much less marked; and these may be called *Escalima murrayi relegata* subsp. nov. The South Australian species referred to *Limæa* must be separated under the new generic name *Gemellima,* as the hinge is practically toothless, while that of *Notolimea* has a very complex series of teeth, quite perpendicular and so unlike that of *Limea strigilata* Brocchi, the type of *Limea,* a fossil figured by Sacco,[16] as to need no detailed comparison.

The type of *Gemellima* is *L. austrina* Tate, and *L. parvula* Verco may at present be associated with it, but, as the hinge is developing strong teeth, and the shell is less solid and smaller and slightly differently sculptured, it must be subgenerically designated with the new name *Isolimea.*

Exosiperna *gen. nov.*

The name *Solamen rex* was proposed for the New South Wales shell previously referred to *Arcoperna,* and a beautiful living specimen was brought in by Howell, so that the soft parts may be later studied. Comparison of the shells included as *Musculus scapha* by Hedley from 80 fathoms, 22 miles off Narrabeen, New South Wales, showed that, while they agreed generically with Verco's species, they differed specifically in shape, being notably broader

[16] Sacco.—I Molluschi terz del Piemonte, part xxv, 1898, p. 21, pl. vi, figs. 4-7.

and more convex, the anterior dorsal border longer and straighter, and the apex much less incurved.

Compared with *Solamen* these shells are much smaller and more solid, with a fine cancellate sculpture; and do not show the hiatus in the sculpture so characteristic of *Musculus* and *Crenella*, while the muscle scars differ. The genus name *Exosiperna* is introduced, with *A. scapha* Verco[17] as type, and the specific name *Exosiperna relata* for the New South Wales species above described.

Family TROCHIDÆ.

For many years the Trochoid shells arranged under the genera *Monilea* and *Minolia* have been confused. An attempt was made in the paper cited[18] to separate the species. A few poor figures were given to assist, but the matter could not be regarded as settled. A further contribution is here added and excellent figures are provided.

The genus *Monilea* was dismissed in the abovenamed paper, while *Minolia* was retained for shells conchologically similar to the Japanese form. Since then, however, Thiele has described the radula of a Japanese species and this is quite unlike the radula of our species. Hence *Minolia* must also be rejected.

Genus SPECTAMEN *Iredale.*

1924. *Spectamen* Iredale, Proc. Linn. Soc. N.S.W., xlix, p. 227, Oct. 24, 1924. Type by original designation, *Trochus philippensis* Watson.

SPECTAMEN PHILIPPENSE (*Watson*).

(Plate xxxix, fig. 2.)

1881. *Trochus philippensis* Watson, Journ. Linn. Soc. (Lond.), Zool., xv, 1881, p. 92; Port Phillip, Victoria. *Id.*, Rep. Sci. Res. Chall., Zool., xv, 1886, p. 73, pl. vi, f. 10.

1918. *Minolia philippensis* Hedley, Journ. Proc. Roy. Soc. N. S. Wales, li, 1918, p. M44.

1924. *Spectamen philippensis* Iredale, Proc. Linn. Soc. N. S. Wales, xlix, 1924, p. 227, pl. xxxv, f. 11.

Contrasted with the succeeding two species this appears to grow to a larger size, and the flames are further apart and consequently fewer than in *bellulum*; in shape less conical but with the striæ of about the same strength. The very close relationship of these three makes it difficult to associate directly the fossil *Monilea strigata* Tenison-Woods, which is apparently an ancestral form of this series.

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[17] Verco.—Trans. Roy. Soc. South Austr., xxxii, 1908, p 196, pl. xii, figs 1-5

[18] Iredale.—Proc. Linn. Soc. N S. Wales, xlix, 1924, pp 227-229

SPECTAMEN BELLULUM (*Angas*).

(Plate xxxix, fig. 1.)

1869. ***Minolia bellula*** Angas, Proc. Zool. Soc., 1869, p. 48, pl. ii, f. 11; Brisbane Water, New South Wales.

1879. ***Trochus dianthus*** Fischer, Coquilles Vivants, Trochus, 1879, p. 396, pl. cxviii, f. 2; new name for *Minolia bellula* Angas.

1918. ***Minolia bellula*** Hedley, Journ. Proc. Roy. Soc. N. S. Wales, li, 1918, p. M44.

1924. ***Spectamen bellula*** Iredale, Proc. Linn. Soc. N.S.W., xlix, 1924, p. 227.

I observed (*loc. cit.*): "The species *bellula* is so close to this (*philippensis*), that it seems a geographical representative, but Hedley has recorded both from localities not very far apart."

The relationship is now known to be specific, as the ranges coincide, but it may be that the present species lives in shallower water. It is easily distinguished by the lack of the colour markings on the base.

SPECTAMEN EPITHECA *sp. nov.*

(Plate xxxix, fig. 8.)

Shell trochoid, of similar appearance to *S. philippense* and *S. bellulum* but easily distinguished by the more pronounced liræ. Colour creamy white, marked with irregular broad flames of red-brown, which persist on to the base, stopping before they reach the umbilical keel. The striæ on the penultimate whorl number fifteen below the shoulder and about six on the shoulder, all well marked and distinct, with no longitudinal striæ to obscure them. In *S. philippense* there are forty to fifty striæ below the shoulder, all closely packed, and none show on the shoulder, the puckering there being more marked.

The umbilicus is narrower, and no keel separates the umbilical cavity, the strong striæ continuing within.

Height, 8·5 mm.; breadth, 10 mm.

Type dredged by Roy Bell in Twofold Bay, New South Wales, 25 fathoms.

Range: New South Wales.

Genus Minolops *nov.*

Type, *Minolia pulcherrima emendata* Iredale.

The shell characters do not show much difference from those of *Minolia,* but the radular features differ widely. Peile[19] has figured that of the present form, while Thiele[20] has described and figured that of *Minolia casta,* which has little to do with our form.

Minolops emendata (*Iredale*).

(Plate xxxix, fig. 5.)

1924. *Minolia pulcherrima emendata* Iredale, Proc. Linn. Soc. N. S. Wales, xlix, p. 229, pl. xxxv, f. 12. Oct. 24, Twofold Bay, New South Wales, 10-25 fathoms.

As suggested at the time of description, this form appears to be of specific rank, five prominent keels being counted on the penultimate whorl, all of equal strength.

Minolops pulcherrima (*Angas*).

(Plate xxxix, fig. 3.)

1869. *Minolia pulcherrima* Angas, Proc. Zool. Soc., 1869, p. 48, pl. ii, f. 10; Brisbane Water, New South Wales.

Two prominent keels with minor intervening liræ give an angulate appearance to the whorls, while the shell is more conical; the striæ are also more pronounced, and the basal liræ less defined, save one very prominent one encircling the umbilical area, which is more contracted than in the preceding form.

Minolops rosulenta (*Watson*).

1886. *Solarium rosulentum* Watson, Rep. Sci. Res. Chall., Zool. xv, 1886, p. 136, pl. viii, f. 12. Off Port Jackson, New South Wales, 35 fathoms.

1903. *Minolia rosulenta* Hedley, Austr. Mus. Mem. iv, 1903, p. 332.

The description and figure suggest relationship with the preceding.

Minolops arata (*Hedley*).

(Plate xxxix, fig. 6.)

1903. *Minolia arata* Hedley, Austr. Mus. Mem. iv, 1903, p. 333, f. 65. Off Botany Bay, 50-52 fathoms, New South Wales.

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[19] Peile.—Proc. Malac Soc (Lond.), xv, 1922, p 17

[20] Thiele —Mitteil Zool Mus. Berlin, xi, 1924, p 58, f 15

Apparently not uncommon on the Continental shelf. I have not recognised Watson's similar *rosulenta,* and was inclined to think these synonymous, but the differently sculptured bases seem to separate them. The operculum seems to differ from that of *Spectamen*; contrast figures 6 and 8.

Genus ETHMINOLIA *Iredale.*

1924. *Ethminolia* Iredale, Proc. Linn. Soc. N. S. Wales, xlix, p. 228. Type by monotypy, *E. probabilis* Iredale.

ETHMINOLIA PROBABILIS *Iredale.*

(Plate xxxix, fig. 4.)

1924. *Ethminolia probabilis* Iredale, Proc. Linn. Soc. N. S. Wales, xlix, p. 228, pl. xxxv, figs. 7-9. Twofold Bay, New South Wales.

1918. *Monilea angulata* Hedley, Journ. Proc. Roy. Soc. N. S. Wales, li, p. M44.

Genus ARCHIMINOLIA *nov.*

This generic name is proposed for the beautiful species named *Monilea oleacea* by Hedley and Petterd.[21] Examination of the type shows it to have a very *Architectonica*-like aspect, and it was suggested that its relationships might be with that family, but its apex proved to be normal, not anastrophic, so that it is truly Trochoid. A resemblance, also superficial, is seen with some species closely related to *Ethalia* and *Umbonium* dredged at Lord Howe Island.

Genus TALOPENA *Iredale.*

1918. *Talopena* Iredale, Proc. Malac. Soc. (Lond.), xiii, 30. Type by monotypy, *Monilea incerta* Iredale.

TALOPENA GLORIOLA *sp. nov.*

(Plate xxxix, fig. 7.)

1918. *Monilea vitiliginea* Hedley, Journ. Proc. Roy. Soc. N. S. Wales, li, p. M44.

The true *vitiliginea*[22] is most probably an *Ethminolia,* with which it agrees in shell characters.

The present species, which has been misidentified in New South Wales with the Western Australian shell, is more like the New

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[21] Hedley and Petterd.—Rec. Austr. Mus., vi, 1906, p. 215, pl. 37, f. 1.
[22] Menke.—Moll. Nov. Holl. Spec., 1843, p. 18.

Caledonian *lifuana*,[23] which is also a *Talopena*, and which also occurs on the Great Barrier Reef. Shell conoidly turbinate, narrowly umbilicate, thin whorls flatly convex, not shouldered. Colour greyish fawn mottled all over with shades of brown, a wavy pattern of angular flames persisting on the base, being indistinctly seen. Apex very small, of about one whorl, six adult whorls succeeding, a slight shoulder seen in the earlier ones, disappearing on the later ones.

Sculpture: fine spiral liræ begin and increase in number throughout, though not showing much more strength in the first and last whorls. On the other hand very fine longitudinal striæ are scarcely discernible on the earliest whorls and are stronger on each succeeding whorl until they almost equal the spirals on the last whorl where they are a little weaker and more numerous and thus produce a weak cancellated effect, which is almost as marked on the base. The whole surface is a dull matt but not roughened.

The aperture is subangulately subcircular, the somewhat angu late periphery being more pronounced at the mouth, the outer lip thin; columella a little curved, bearing a funicle medially, which runs up the umbilical cavity. The umbilicus deep narrow bounded by a thickened rib which continues to the columella.

Height, 10 mm.; breadth, 11·5 mm.

Range.—New South Wales; type collected at Manly

ASTELE SUBCARINATA *Swainson.*

It is a pleasure to add this magnificent Trochoid to the New South Wales fauna, and a splendid living specimen secured off Montague Island in 55-60 fathoms makes its entry definite. I have been unable to note any difference from the normal Tasmanian form, but it may be that a series would show variation.

The references for both genus and species read:

1854. *Astele subcarinata* Swainson, Proc. Roy. Soc. Van Diemen's Land, iii, p. 36, pl. vi, figs. 1-2. Tasmania.

1863. *Eutrochus perspectivus* A. Adams, Proc Zool. Soc., 1863, p. 506. Tasmania.

1889. *Calliostoma* (*Eutrochus*) *adamsi* Pilsbry, Man. Conch. (Tryon), xi, 402, new name for *E. perspectivus* A. Adams.

1893. *Astele subcarinata* Brazier, Proc. Linn. Soc. N. S. Wales, (2), viii, p. 107-110, figs. in text.

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[23] Fischer.—Journ. de Conch., xxvi, 1878, p. 63.

XENOPHORA TATEI *Harris.*

Hedley[24] added this fossil to the recent fauna from half-grown dead examples from off Port Kembla in 63-75 fathoms. As usual young examples are umbilicate, while adults are imperforate. A couple of odd living adult shells secured some time since threw doubt upon the identity of the recent and fossil species. A large series collected by Howell has shown that though the recent shell is certainly separable from the fossil it is scarcely distinguishable from the Neozelanic species. The Australian shells do not reach the size of the examples from New Zealand and are comparatively broader and less elate. It will be best to distinguish the local form as *Onustus peronianus*; photographs of this shell have been published in the Austr. Mus. Magazine, vol. iii, 1927, p. 57. An obvious means of separation will be the shells carried by the species. Finlay[25] has written about the reinstatement of the well-known *Onustus* for this genus.

Family CYMATIIDÆ.

Hedley[26] broke new ground when he described the deepwater form of the common shell known as *Septa rubicunda* Perry (olim *Triton nodiferus* Lamarck) as *Charonia nodifera* var. *euclia.* After discussing and figuring this West Australian form he added: "Since writing the above a series has been received from the 'Endeavour,' trawled off the South East Coast."

Odd specimens have since come to hand, and when Howell brought in shells referable *sensu lato* to *C. rubicunda* Perry, *Cymatium spengleri* Perry, and *Mayena australasia* Perry, all trawled together alive, the matter was reopened. All were seen to vary from the littoral forms in the same manner, elongation of the spire and more definite sculpture. Reconsideration forced the conclusion that the East Australian form differed from the true *euclia* in being comparatively broader and more regularly nodulose with other minor details. Also the relationship was with the Australian *rubicunda,* and not with the Mediterranean *nodiferus,* but certainly there appeared to be full specific validity. The deepwater shells are therefore regarded as a species *Charonia euclia* and the eastern shell here figured (Plate xli, fig. 5) is named subspecifically as *Charonia euclia instructa* nov.

The difference between *euclia* and *rubicunda* was readily seen when Howell brought in a large shell of the latter measuring 185 mm. in length with a breadth of 125 mm., proportions quite unlike

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[24] Hedley.—Mem. Austr. Mus., iv, 1902, p. 357.
[25] Finlay.—Trans. New Zeal. Inst., lvii, 1926, p. 391.
[26] Hedley.—Zool. Results "Endeavour," ii, 1914, p. 65, pl. viii.

that of *euclia*, 200 mm. by 100 mm. In addition the coloration of *rubicunda* was deep reddish brown, with brown markings on the mouth, while *euclia* was marked with pale orange brown, with dull pale brownish mouth markings. The sculpture in the latter was much bolder and the varices more flattened back, and therefore more projecting.

It may be noted that Finlay recorded *euclia* from off the southern New Zealand coast in deep water, and then determined the shells to be deepwater derivatives of the Neozelanic littoral representative of the Australian *rubicunda*. Again it is curious that no littoral form of this grown has yet been found in Western Australia, whence *euclia* was first described.

As to the *Cymatium spengleri* series, the deepwater form is obviously more elongate and regular in growth. Through breakage sometimes an elongate specimen of the shore shell may be found, but when compared with the benthal shell it is seen to be quite irregular. The Victorian form of *spengleri* is much more obese than the New South Wales shell, which is typical, and will bear the name C. *spengleri barthelmyi* Bernardi.[27]

I have already recorded that this was a variant and undoubtedly the name refers to the Victorian form.

I acquiesced in Hedley's suggestion that A. Adams' *boltenianum* was an aberration of *spengleri*, but more intensive collecting has negatived that idea, and it is here reinstated as a valid species, apparently never growing any larger than the specimen figured (Plate xli, fig. 7), which has been compared with the type and agreed very accurately in detail. The deepwater form of *spengleri* figured (Plate xli, fig. 1) is here named *Cymatium* (*spengleri*) *procerum* nov.

Variation has long been noted in connection with *Mayena australasia* Perry, but it was difficult to diagnose geographical races, though there can be no hesitation in recognising the deepwater form here figured. Many specimens have now been secured, and all agree in the strong nodulation and the elongate spire, the spire being longer than the aperture. There are eight adult whorls, with a varix each half whorl, but these are a little irregular. The main sculpture is the two strong, nodulate, peripheral keels, whereas in the shore forms one is the rule, and when two are present one is much weaker, the nodules smaller and more numerous.

An immature specimen trawled at the same time shows the protoconch to survive as three and a half brown subglobose whorls but the apex is still missing. The first sculptured whorl has five concentric ridges with minor threads between, and overrun by fine

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[27] Bernardi.—Journ de Conch., (2), ii, 1857, p 54, pl 1, f. 1.

longitudinal scratchings; longitudinal ribs begin forming almost at once, and eight can be counted on the next half whorl, where a varix is formed; on each succeeding half whorl the nodules grow stronger, and on the fourth whorl the second row begins, the peripheral row being now well formed and angulately nodulose. I am naming this benthal form *Mayena* (*australasia*) *benthicola* nov. (Plate xli, fig. 4). As the slender form of *Cymatiella* has again turned up, being brought in by Howell from off Montague Island, it becomes necessary to review the *Cymatiella* group. With a good series available the forms recognised by Australian conchologists were easily determined, and I now conclude that Reeve's *quoyi* is an absolute synonym of his *verrucosus*, and that *eburneus* is certainly not Australian.

The Australian shell regarded as *eburneus* has very fine sculpture and is a comparatively broad shell; specimens are in this Museum from many places in Victoria, South Australia, and the east coast of Tasmania.

The South Australian shell here named *quoyi* is narrow and strongly sculptured but has the mouth contracted, which distinguishes it at sight from true *verrucosus*, which has even bolder sculpture and the mouth open.

The true *verrucosus* also occurs in South Australia, but appears to be most typical in Victoria, the east Tasmanian form being elongate and strongly sculptured like the New South Wales shell and closely allied to *columnaria*.

A better nomenclature would be thus displayed:

Cymatiella verrucosa Reeve. Victoria, South Australia.
peroniana nov. New South Wales, east Tasmania.
columnaria Hedley and May. East Tasmania, 100 fathoms.

Cymatiella lesueuri nov. = *eburneus* of Australian writers. Victoria, South Australia, east Tasmania.

Cymatiella gaimardi nov. = *quoyi* of South Australian writers. South Australia.

Most accounts can be reconciled by this means, as Pritchard and Gatliff were correct in regarding *quoyi* and *verrucosus* as synonyms and *eburneus* as distinct. Kesteven, who figured the apices of these species as distinct, handled the three I have discriminated, as proven by the specimens he named and figured in the Australian Museum. The species, as now distinguished, are therefore redescribed and figured here, and it is hoped the confusion will be dispelled by the study of the details given.

CYMATIELLA VERRUCOSA *Reeve.*

(Plate xl, fig. 2.)

Triton verrucosus Reeve, Conch. Icon. Triton, June, 1844, pl. xvii, f. 71. Hab.?

Triton quoyi Reeve, *ibid.*, pl. xix, f. 93. New Holland. Restricted type locality Victoria; specimen here figured from Port Phillip.

Shell small, variced, varix every three-fourths of a whorl.

Adult whorls five and one half in number, strongly sculptured, apex smooth.

Nine strong, longitudinal ridges can be counted between each varix, while these are over-ridden by nearly the same number of concentric ridges on the last whorl, a peripheral one forming a shoulder, above which lie two others and below about six similar ones: Two or three finer cords appear between each ridge, and throughout there is a fine longitudinal scratching.

Colour pale cream, a fine velvety periostracum present when living.

Mouth open, canal short, columella curved with four or five nodules present anteriorly; heavily varicose; inside the outer lip are six elongated separate teeth.

Length, 24 mm.; breadth, 13 mm.

CYMATIELLA LESUEURI sp. nov.

(Plate xl, fig. 11.)

Shell a little smaller than the preceding, similar in shape.

Adult whorls five, more finely sculptured, apex missing in shell figured.

The last adult whorl is sculptured with fifteen concentric cords between the varices, scarcely showing any subsidiary inter vening ones except towards the base; longitudinal ridges obsolete but cords all beaded; on earlier whorls longitudinals are a little more pronounced.

Colour of dead shells chalky white, living ones not yet seen.

Mouth open, canal short, columella a little curved, showing anteriorly four short ridges; outer lip heavily variced; internally six short conical teeth appear.

Length, 19 mm.; breadth, 10·5 mm.

Type from Port Phillip, Victoria.

Range: Victoria, South Australia, east Tasmania.

This is the species known as *eburnea*, but it is certainly not *Triton eburneus* Reeve.

Cymatiella gaimardi *sp. nov.*

(Plate xl, fig. 7.)

Shell smaller than preceding, more attenuate and narrower.

Adult whorls six, strongly sculptured, apex smooth.

Sculpture formed of about nine strong primary ridges with a dozen subsidiary ones, while about twelve longitudinals between each varix form nodules at the intersections.

Colour golden brown.

Mouth cramped posteriorly, canal short, columella almost straight, posteriorly even a little cut back, a couple of strong teeth showing on anterior part of columella. Outer varix of mouth not as strong as in the preceding, while internally there are four or five short teeth.

Length, 15·5 mm.; breadth, 7 mm.

Type from Port Lincoln, South Australia.

Range: South Australia.

Cymatiella peroniana *sp nov.*

(Plate xl, fig. 9.)

Shell in size and shape as preceding, but with a long canal and more open mouth.

Adult whorls nearly six, strongly sculptured, apex smooth, three whorled.

Sculpture consists of seven strong concentric chords with about twenty smaller thread-like ones; about a dozen longitudinal ridges form nodules at their intersection; three more prominent peripheral ridges are seen on the antepenultimate whorl.

Colour white, periostracum brown and very thin.

Mouth small, open, canal long, columella curved, three teeth very close together anteriorly, varix not very crass but prominent, with six short teeth internally.

Length, 16 mm.; breadth, 7.25 mm.

Type trawled off Montague Island, New South Wales, 50-60 fathoms.

Range: Southern part of New South Wales coast in deep water.

CYMATONA *gen. nov.*

This genus is provided for the shell described by Watson[28] as *Nassaria kampyla,* and figured under the name *Nassaria campyla.*[29] It appears to be the most common of the family on the Continental shelf. The very long oblique canal is characteristic, and it appears to have no close relationship with the genus *Fusitriton.*

The latter genus is represented by Hedley's *retiolus,* and the genus occurs in deep water off the extremities of South America, South Africa, eastern Australia and New Zealand, and thus has an antarctic range coincident with the littoral form for which Finlay[30] has introduced the generic name *Gondwanula,* naming *Ranella tumida* Dunker as type. The name seems to have been chosen through an unfortunate misapprehension of the data.

NEGYRINA, *gen. nov.*

This generic name appears to be necessary for the curious species *Triton subdistortus* Lamarck,[31] which appears to have no definite resting-place. This course is taken as it now has to be added to the New South Wales list, a living specimen being brought in by Howell from off Montague Island in 55-60 fathoms. This shell agrees too closely with Victorian specimens for separation, though later this course may be necessary.

I have added *Cymatium waterhousei* A. Adams and Angas[32] to our list, and I now find it necessary to distinguish the New South Wales form under the name *Cymatium waterhousei frigidulum* nov. (Plate xli, fig. 2), as it is altogether narrower than the South Australian typical form, measuring 75 mm. in length and only 35 mm. in breadth, with six adult whorls; there are six pronounced varices, a varix every three-fourths of a whorl, the earlier whorls unvariced. The colour is pale straw and the periostracum fine. The interior of the mouth is not ridged and the varix of the outer lip shows the external sculpture, not internal as in *spengleri.*

The New South Wales members of the family would now be:

Charonia euclia instructa Iredale.
Charonia rubicunda Perry.
Charonia pumilio Hedley.
Austrotriton parkinsonius Perry

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[28] Watson.—Journ. Linn. Soc. Lond., Zool. xvi, 1885, p. 594.
[29] Watson.—Rep. Sci. Res. Chall. Zool. xv, 1886, p. 405, pl. xiv, f. 12.
[30] Finlay.—Trans. New Zeal. Inst., lvii, 1926, p. 399, 1927.
[31] Lamarck.—Hist. Anim. s. Vert., vii, 1822, p. 186.
[32] Iredale.—Rec. Austr. Mus. xiv, 1925, p. 261.

Austrotriton (*parkinsonius*) *basilicus* Iredale.
Distorsio reticulata Bolten.
Cymatium caudatum Gmelin.
exaratum Reeve.
gemmatum Reeve.
labiosum Wood.
australasia Perry.
sinense Reeve.
waterhousei frigidulum Iredale.
spengleri Perry.
(*spengleri*) *procerum* Iredale.
boltenianum A. Adams.
pyrum Linné.
zimara Iredale.
nicobaricum Bolten.
Cymaticlla peroniana Iredale.
Cymatona kampyla Watson.
Fusitriton retiolus Hedley.
Negyrina subdistorta Lamarck.
Mayena australasia Perry.
Mayena (*australasia*) *benthicola* Iredale.

CHARONIA PUMILIS *Hedley*.

The species *Charonia pumilio* Hedley has not again turned up and may be the juvenile of a large form.

In the deep water there appears to be more than one species referred to *Austrotriton* but the material is not sufficient to determine yet.

The genus *Cymatium* requires revision, but as most of those here named belong to northern groups, they will be attended to in connection with Queensland shells now being studied. Thus the forms classed under *caudatum* Gmelin and *sinense* Reeve certainly need reconsideration, while two different shells are called *exaratum* Reeve, and the Sydney form, which is, however, not common, may need differentiation.

The species classed by Hedley under *Gyrineum* and *Bursa* are known in New South Wales only as stragglers, and are also under consideration in connection with Queensland shells.

XENOGALEA SPECTABILIS *sp. nov.*

(Plate xxxviii, fig. 6.)

As my review was going through the press I added in connection with *X. paucirugis* (p. 346)[33] that Mr. W. Boardman had

[33] Iredale.—Rec. Austr. Mus. xv, 1927, pp. 321-354.

brought in a shell from off Montague Island which agreed with specimens from the Ninety Mile Beach, Victoria, which my friends in Victoria, Messrs. Gatliff and Gabriel, regarded as *pyrum*, from which conclusion I dissented. The magnificent specimen brought in by Howell, also from off Montague Island, definitely proves this form to be a distinct species. It is as large as the largest *stadialis* but is much thinner, and has a shorter spire and a double peripheral keel.

Shell large, globose, thin, spire very short, a little attenuate, less than one-third the length of the aperture. Whorls somewhat roundly shouldered, the shoulder most marked and subangular in body whorl.

Early whorls sculptured with close concentric lines, a few slanting threads becoming more prominent on the third adult whorl and then vanishing. Body whorl smooth save for growth lines and the shoulder ridges. Aperture reverse earshaped, elongate; outer lip rolled back, smooth within.

Coloration pinkish cream marked with seven brown bands showing most strongly on the outer lip.

Apical whorls four, very regularly wound, beginning from a very small whorl and increasing slowly; six adult whorls, the last increasing very rapidly. On the third a shoulder develops and on the fourth this becomes rounded and succeeded by a groove, which is more pronounced on the next whorl, and on the last whorl another groove succeeds, the median shoulder ridge becoming closely nodulose.

Canal short, recurved, preceded by a long broad gutter running into a deep false umbilicus, which is entirely hidden from the front by the reflection of the inner lip. Snout a little turned back; an umbilical chink persisting; columella internally wrinkled, half a dozen being counted when the shell is twisted, a couple only seen from the outside. Aperture fairly wide.

Length, 100 mm.; breadth, 74 mm.

Type from off Montague Island, New South Wales, 50-60 fathoms.

Natica luculenta *sp. nov.*

(Plate xl, fig. 10.)

This beautiful species, with the facies of a tropical shell, may be related to some fossil form, but the characteristic colouring of the recent shell would be missing; otherwise it suggests *sagittata* or *gualteriana* as being a deepwater relative.

Shell globose, thin, spire short, mouth large, umbilicus small.

Colour shining buffy cream, regularly spotted with splashes of orange brown.

Apex minute, whorls six rapidly increasing, smooth save for very fine growth striæ; sutures lightly impressed, edges plain. Aperture large, semilunate. Umbilicus open but narrow with a small distinct funicle leading into it from the inner lip, which posteriorly develops a callus spreading on to the body whorl as it reaches the outer lip. Operculum unknown.

Height, 24 mm.; breadth, 21·5 mm.

Trawled off Montague Island, New South Wales, 50-60 fathoms.

Family VOLUTIDÆ.

I[34] gave a few notes on the species, and, noting that Hedley regarded *Voluta maculata* Swainson as the type of *Scaphella*, renamed the species *Scaphella caroli*. At Dr. Marwick's request I re-examined the matter and he[35] has published a note pointing out the rejection of *Scaphella*, the type being *V. junonia* Hwass.

The next name for the *undulata* series appears to be *Amoria* Gray,[36] though the species are not typical, *Amoria* properly belonging to the tropical group of *volva* Gmelin, the type being *turneri* Gray and its associates. The correct course would be to separate the lined southern forms under the subgeneric name *Amorena* nov., the form, apex and columellar plaits differing, while another subgenus should be created for the *zebra* series under the name of *Zebramoria*, the same details showing differing features.

As Marwick noted the type of *Cymbiola* is *Voluta cymbiola* and the species allotted to this genus by Hedley need distinction, as none agrees with that type. Neither can the three associated by Hedley be kept together, unless subgeneric distinction only be allowed for the differences observed.

The species *V. magnifica* Perry is of large size, has four delicate plaits and a very regularly wound small protoconch. The second species, *V. marmorata* Swainson, is a smaller species with a smaller, more conical, regular protoconch, the plaits better marked and an altogether differently shaped mouth, approaching more the true *Cymbiola* in that respect. As to *V. punctata* Swainson, which I renamed *Cymbiola complexa*, it is a small crass shell, the protoconch missing in the specimens examined, the plaits very thick and pronounced and recalling some species allotted to *Cymbiola*, but obviously with a different protoconch, as theirs is planate and therefore always present.

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[34] Iredale.—Proc. Linn. Soc. N. S. Wales, xlix, 1924, p. 258.
[35] Marwick.—Trans. New Zeal. Inst., lvi, 1926, p. 264.
[36] Gray.—Proc. Zool. Soc., 1855, p. 64 (May 16th).

It seems best to differentiate *V. magnifica* as a new genus *Cymbiolena* and introduce *Cymbiolista* as a new subgenus, with *V. marmorata* as type, and *Cymbiolacca* as another new subgenus, with *Cymbiola complexa* as type.

Brazier's *Voluta kenyoniana* was degraded to the rank of a variety of *papillosa* by Verco[87] and this was accepted by Hedley. As only the supposed variety comes from the New South Wales coast it is here reinstated with specific rank, and if it be regarded as an *Ericusa,* then the species known as *sowerbyi* Kiener must be generically separated. The short stout form of *kenyoniana* is quite unlike the graceful elongate shape of the so-called *sowerbyi,* whose plaiting is very different. While *sowerbyi* has delicate sloping plaits, *kenyoniana* has very crass thickened ones. The name *Voluta sowerbyi* Kiener can be applicable only to the south Tasmanian shell, and the New South Wales species differs in its larger size, lengthened spire, narrower build, and somewhat different colora tion, and is here separated with the name *Mesericusa sowerbyi perspecta* nov. (Plate xli, fig. 9). This is one of the commonest shells brought up by the trawl, and large and small shells are constantly found. There seems to be a distinct discrepancy in size as shown in the photograph, the large form measuring 260 mm. in length and 140 mm. in breadth, the small one being only 95 mm. by 38 mm. As these are always found and always seem to be adult, it is suggested that the dwarfs are males and the large specimens are females. It may be noted that this marked size distinction has not been noted in connection with other Australian Volutes on the east coast, but that Verco[88] has observed it in South Australian waters in connection with *S. fulgetrum* Sowerby.

A very curious little shell suggesting *undulata* in miniature is intróduced as

NANNAMORIA AMICULA *gen. et sp. nov.*

(Plate xl, fig. 4.)

Shell very small, spire less than half the length of the aperture, acuminate.

Colour of dead shell white with yellow irregular longitudinal lining.

Sculpture consists of eight nodules on shoulder of last whorl, with about twelve on the preceding two, a three-whorled regular smooth protoconch present. The last whorl shouldered, the mouth narrow, almost linear, the outer lip thickened but not varicose.

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[87] Verco—Trans. Roy Soc South Austr, xxxvi, 1912, p 228

[88] Verco.—*Loc. cit.,* p. 222.

The columellar plaits are six in number, three large alternating with three smaller.

Length, 27·5 mm.; breadth, 12 mm.

Trawled off Montague Island, New South Wales, 50-60 fathoms.

CONUS HOWELLI *sp. nov.*

(Plate xl, figs. 1, 8.)

This most striking discovery, resembling no recent member of our fauna, recalls the Eocene fossil *Conus ligatus* Tate,[89] which is comparatively coarser.

Shell of medium size, elegantly coniform, sharply angulate at the shoulder, early whorls concave above, spire acute, less than half the length of the aperture, the apical whorls missing, apparently papillate.

Colour pale dove grey, the body whorl encircled with three underlying bands of paler hue made up of slanting, white, linear marks. Adult whorls eight, sculpture of spire consisting of concentric growth lines only, the peripheral carina being subcrenulate; the growth lines become fainter on the body whorl, where anteriorly revolving liræ persist in a subdued manner.

Aperture linear, canal short narrow, outer lip thin.

Length of type, 27 mm.; breadth, 13·25 mm.

Trawled off Montague Island, New South Wales, 50-60 fathoms.

LARGISIPHO (OLIGOSTIRA) SPECTANDA *nov.*

(Plate xli, fig. 6.)

Shell large, regularly fusiform, spire a little shorter than the aperture.

Colour brownish cream.

Apical whorls missing, adult whorls eight, regularly increasing, convex, obsoletely subangulate at the shoulder.

The sculpture consists of closely packed concentric cords with narrow interspaces, each interval bearing a thread; about sixteen of these can be counted upon the penultimate whorl; about sixteen rounded ribs may be distinguished running longitudinally down the shell, but ill-defined and only pronounced as peripheral elongate nodules, becoming obsolete on the last whorl, until they reappear

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[89] Tate.—Trans. Roy. Soc. South Austr., xiii, 1891, p. 198, pl. viii, f. 9.

as nodules near the aperture. Growth threads over the whole surface are weakly seen. Inner lip curved and spreading into a thin glaze on the body whorl, smooth, outer lip slightly thickened and internally ridged, agreeing with the external sculpture. Canal long, curved.

Length, 135 mm.; breadth, 61 mm.

Trawled off Montague Island, New South Wales, 50-60 fathoms.

When Tate[40] introduced the species from South Australia he called *Siphonalia oligostira,* he contrasted it with the Neozelanic *mandarina,* but noted the difference in the nuclear whorls. This difference has been found to persist between the Neozelanic *dilatata* and the Australian *maxima,* and consequently my generic name *Verconella* must be used in connection with the former. The name *Austrosipho,* proposed for the fossil *F. roblini* Ten. Woods, was suggested as available for these Australian species, but that species recalls *Propefusus* or *Berylsma* as much as the present series. As there appears to be some confusion in connection with the fossils, it is considered inadvisable to cause further perplexity, and therefore the new name *Largisipho* is introduced, the present species being named as type. It differs from *S. oligostira* in form and nodulation but appears closely related; it is easily separated from *Berylsma* by its broader build, more open mouth, and shorter canal, and especially by the facies, which is definitely that of the "*Verconella*" series.

RATIFUSUS ADJUNCTUS *gen. et sp. nov.*

(Plate xl, fig. 5.)

Shell small, regularly fusiform, spire longer than aperture, whorls convex, sutures deep, aperture subvaricose, with suggestion of posterior sinuation, canal short, open.

Colour white, irregularly blotched with orange brown, running into bands below the suture and about the periphery of the last whorl.

Apical whorl minute, tilted, smooth, half immersed in succeeding whorl, which is also smooth; another smooth whorl follows and then sculpture begins without any indication of a varix. The sculpture begins as concentric liræ about eight in number, with longitudinal growth lines, producing an obsolete cancellation. An obscure varix is indicated at the end of the next whorl, and there are suggestions of indefinite varices about every whorl. The cording continues, increasing in number but not in strength, and the growth lines similarly remain weak, so that a subdued, minute, cancellate effect is produced.

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[40] Tate.—Trans. Roy. Soc. South Austr., xiii, 1891, p. 258, pl. xi, f. 6.

The outer lip is thickened and bevelled but not strongly varicose, and quite smooth inside; a sinuate curve suggesting an anal groove may be seen, and the outer runs up the body whorl a little, forcing the spire into an excentric position. The mouth is fairly wide, oval, anterior canal short and open. Columella smooth, inner lip a little reflected forming a slight body glaze.

Length, 16 mm.; breadth, 5 mm.

Trawled off Montague Island, New South Wales, 50-60 fathoms.

This is another member of the series recently called *Fusus*, and differs from *F. mestayeræ* and *schoutanicus* in the suppression of the varices and in nuclear features. There appear to be two series of similar species living in southern waters, as well as my *Obex* form, and, though of complex nature, the group is of great age, many forms being known from the fossil beds of Victoria and South Australia. It will be a difficult task and will need much material to correlate the recent and fossil forms, as in both cases species very similar, but certainly distinct, have already been found.

XENOTROPHON EUSCHEMA *gen. et sp. nov.*

(Plate xl, fig. 3.)

Shell small, tumid, fusiform, spire a little shorter than aperture, mouth rounded, free, canal long, straight and narrow.

Colour creamy white.

Protoconch of one and a half smooth whorls, apex incurved, flattened, the succeeding four adult whorls separated by an obsolete varix.

Adult sculpture begins with two concentric ridges, the upper one forming a shoulder, the lower a peripheral ridge; these two persist and a minor ridge appears above the shoulder and six to eight below, all weaker than the primary ones. Longitudinal growth lines developing into wrinkled, laminate, erect frills appear, about one dozen on the first adult whorl; this sculpture continues irregularly the frills are much stronger, as if representing growth periods.

The mouth is rounded, the outer lip thickened but not varicose; the inner lip developed and freed from the body whorl, an umbilical chink being present.

Length, 17·5 mm.; breadth, 10 mm.

Type trawled off Montague Island, New South Wales, 50-60 fathoms.

The generic name *Trophon* has been used for a series of large and small shells, most unlike the genotype and has been rightly dismissed from the Neozelanic list by Finlay,[41] who showed that the shells most like *Trophon* differed both in radular characters and in apical features. The only Australian shell at all recalling the genotype is the deepwater *carduelis* Watson,[42] and in detail this is so dissimilar, a definite and very important feature being the plugging of the decapitated apex, a feature quite foreign to the true *Trophon*. The new generic name *Enixotrophon* is introduced for this species alone.

Another species at once separable is the *Murex licinus* of Hedley and Petterd, afterwards transferred to *Trophon*, which has a short squat shape, with short spire, huge open mouth, and short open canal, which is here designated with the new generic name *Emozamia*.

The little shell Hedley called *Trophon simplex* is a common member of the Shelf fauna, and is generically named *Enatimene*, the small apex, medium spire, delicate shape, long recurved canal, and free mouth, making it a striking form, the sculpture being an obsolete clathration.

The minute shore shells such as *rudolphi*, *goldsteini* and *braziert* may be named *Litozamia*, their short fusiform shape, with a medium canal and a smooth apex, with their purplish tone of coloration, differentiating them from the preceding groups; *rudolphi* is named as type. Another well marked series is represented in the species adorned with frilled longitudinal laminæ after the style of the true Trophons. The generic name *Gemixystus* is proposed, and *laminatus* is named as type. This species has a short spire, open mouth, long recurved canal, and laminate sculpture; the apex is angulate. *T. stimuleus* is very similar but has a smooth rounded apex, a feature otherwise regarded as generic, but it is here named *Apixystus*, with subgeneric value only. A deepwater form appears in *segmentatus*. A beautiful form with the same kind of sculpture, but perhaps unrelated, is *columnarius*, with a very long spire and very long apex and short canal. It is here generically named *Benthoxystus*, and the littoral *petterdi* may belong here, being similar but not of such striking proportions.

Two very different species, which do not appear to belong to this association of molluscs, were added by Hedley and May. The first, *Trophon molorthus*, has a long spire, a small apex, a medium canal, and a narrow mouth; it has a sculpture of concentric cords overrunning longitudinal waves, quite unlike any other of the

[41] Finlay.—Trans. New Zeal. Inst., lvii, 1926, p. 419-425.
[42] Watson.—Rep. Sci. Res. Chall., Zool., xv, 1886, p. 167, pl. 10, f. 7

species above treated. The new generic name *Ollaphon* is introduced for this species, and it would be better placed near *Fusinus*.

Still more distinct is *Trophon sarmentosus*, with its long spire, short canal, and distinct semivaricose sculpture, recalling that of *Galfridus*, whose relation it may be. Until this can be determined it may be regarded as a genus *Anatrophon*, and *latior* may be a deepwater relation.

With time and material it would probably be easy to link up these recent species with the fossils and thus prove their distinct origin. In May's Checklist of the Mollusca of Tasmania the species named *Donovania fenestrata* by Tate and May[43] has been transferred to *Trophon*. It does not appear to have anything to do with this series, and still less with *Donovania* = *Syntagma*; it is here differentiated generically with the name *Gatliffena*, as a mark of respect for the venerable Victorian collector, J. H. Gatliff.

Tolema *gen. nov.*

(Plate xli, figs. 3, 8.)

This genus is introduced for *Purpura sertata* Hedley,[44] which was afterwards regarded by its author as synonymous with *Coralliophila lischkeana* Dunker,[45] a Japanese species. The adult shell has not yet been figured, as Hedley's species was based on an immature shell. It is quite like the Japanese form but is separable by means of the sculpture; it is a resident of our deeper water. The genus *Coralliophila*[46] has been utilised to cover many diverse forms of coral-living mollusks, and its type was fixed as *P. neritoidea* Lamarck,[47] which is not closely related to the present beautiful group, which, in connection with Japanese species, has been referred to the neighbourhood of *Latiaxis*.

Mathildona euglypta *gen. et sp. nov.*

(Plate xl, fig. 6.)

This very beautiful shell was recognised at sight as very closely resembling the true *Mathilda* Semper, based upon an Italian fossil. The other Australian species heretofore classed under *Mathilda* are quite unlike the type and also unlike each other. Shell tall, tapering, slender, thin, whorls rounded, regularly increasing, base rounded, imperforate. Apex anastrophic, tilted, slightly immersed

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[43] Tate and May.—Trans. Roy. Soc. South Austr., xxiv, 1900, p. 94.
[44] Hedley.—Austr. Mus. Mem. iv, 1902, p. 382, figs. 95, 96
[45] Hedley.—Rec. Austr. Mus. vi, 1906, p. 219.
[46] H. and A. Adams.—Gen. Rec. Moll. i, 1853, p 135.
[47] Iredale.—Proc. Malac. Soc. (Lond.), x, 1912, p. 221.

by succeeding whorls, smooth. Colour of shell creamy white, apical whorls red-brown. The sculpture is composed of strong concentric ridges overridden by fine, close, longitudinal threads, forming a beautiful clathration. At first there are only three ridges but later subsidiary ones develop, though the primary three remain the most prominent. About forty longitudinals may be counted, which become weaker on the base, where six weak cinguli persist. The mouth is subcanaliculate, a weak basal notch appearing in front of the slightly twisted columella, outer lip thin.

Length 20 mm.; breadth 7 mm.

Trawled in 50-60 fathoms off Montague Island, New South Wales.

Nearest the fossil type of *Mathilda,* this species differs in the form of the protoconch, and Cossmann has separated the Palæarctic fossils into groups by means of this feature so that it is necessary to avoid confusion to designate the Austral groups also. The fossil *Scalaria triplicata* Tate suggests comparison.

Finlay[48] has already introduced *Brookesena* for Suter's *Mathilda neozelanica,* observing that the Australian *decorata* is not congeneric, the resemblance being merely superficial.

Mathilda rosæ Hedley is quite unlike any other form; the anastrophic apex is succeeded by a long spiral with sharp cinguli but no longitudinals, spreading to a square base with a square mouth and a deep perforation. The new generic name *Charilda* is introduced for this alone. More different still is the beautiful shell named *elegantula* by Angas, with a longer spire, a tilted turbinate apex, a subplicate columella and lirate sculpture; it is imperforate, though the mouth is squarish. For this species the new genus *Eucharilda* is proposed, while *Opimilda* is added for *decorata* Hedley, a short, squat, perforate shell, quite dissimilar.

The new names introduced in this paper are:

Nucula obliqua subdilecta subsp. nov.
Scæoleda gen. nov.: type *Nucula crassa* Hinds.
Scæoleda crassa illepida subsp. nov.
Teretileda gen. nov.: type *Nuculana oculata* Iredale.
Magaleda gen. nov.: type *Leda inopinata* E. A. Smith.
Thestyleda gen. nov.: type *Leda ramsayi* E. A. Smith.
Comitileda remensa sp. nov.
Poroleda flindersi sp. nov.
Microcucullæa gen. nov.: type *Bathyarca perversidens* Hedley.

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[48] Finlay.—Trans. New Zeal. Inst lvii, 1926, 1927, p. 389.

Microcucullæa adelaideana sp. nov.
Loringella gen. nov.: type *Limopsis loringi* Angas.
Phrynelima gen. nov.: type *Limopsis brazieri* Angas.
Aspalima gen. nov.: type *Limopsis erectus* Hedley and Petterd.
Aspalima erecta idonea subsp. nov.
Cyrillona gen. nov.: type *Cyrilla dalli* Hedley.
Cyrillista gen. nov.: type *Nuculina concentrica* Verco.
Glycymeris magnificens sp. nov.
Glycymeris broadfooti sp. nov.
Mesopeplum gen. nov.: type *Mesopeplum caroli* Iredale.
Mesopeplum caroli sp. nov.
Mimachlamys gen. nov.: type *Pecten asperrimus* Lamarck.
Scæochlamys gen. nov.: type *Pecten lividus* Lamarck.
Equichlamys gen. nov.: type *Pecten bifrons* Lamarck.
Belchlamys subgen. nov.: type *Pecten aktinos* Petterd.
Talochlamys subgen. nov.: type *Chlamys famigerator* Iredale.
Veprichlamys subgen. nov.: type *Chlamys perillustris* Iredale.
Chlamydella gen. nov.: type *Cyclopecten favus* Hedley.
Ctenamusium gen. nov.: type *Amusium thetidis* Hedley.
Ctenamusium salacon sp. nov.
Spondylus (tenellus) regillus nov.
Austrolima gen. nov.: type *Lima nimbifer* Iredale.
Austrolima nimbifer gemina subsp. nov.
Austrolima spectata sp. nov.
Escalima gen. nov.: type *Limea acclinis* Hedley.
Escalima murrayi maugeana subsp. nov.
Escalima murrayi relegata subsp. nov.
Gemellima gen. nov.: type *Limæa austrina* Tate.
Isolimea subgen. nov.: type *Limæa parvula* Verco.
Exosiperna gen. nov.: type *Arcoperna scapha* Verco.
Exosiperna relata sp. nov.
Spectamen epitheca sp. nov.
Minolops gen. nov.: type *Minolia pulcherrima emendata* Iredale.
Archiminolia gen. nov.: type *Monilea oleacea* Hedley and Petterd.
Talopena gloriola sp. nov.
Onustus peronianus sp. nov.
Charonia euclia instructa subsp. nov.
Cymatium (spengleri) procerum nov.
Cymatium waterhousei frigidulum nov.
Mayena (australasia) benthicola nov.
Cymatiella peroniana sp. nov.
Cymatiella lesueuri sp. nov.
Cymatiella gaimardi sp. nov.

Cymatona gen. nov.: type *Nassaria kampyla* Watson.
Negyrina gen. nov.: type *Triton subdistortus* Lamarck.
Xenogalea spectabilis sp. nov.
Natica luculenta sp. nov.
Amorena subgen. nov.: type *Voluta undulata* Lamarck.
Zebramoria subgen. nov.: type *Voluta zebra* Leach.
Cymbiolena gen. nov.: type *Voluta magnifica* Shaw and Nodder.
Cymbiolista subgen. nov.: type *Voluta marmorata* Swainson.
Cymbiolacca subgen. nov.: type *Cymbiola complexa* Iredale.
Mesericusa gen. nov.: type *M. sowerbyi perspecta* Iredale.
Mesericusa sowerbyi perspecta subsp. nov.
Nannamoria gen. nov.: type *Nannamoria amicula* Iredale.
Nannamoria amicula sp. nov.
Conus howelli sp. nov.
Largisipho gen. nov.: type *Largisipho (oligostira) spectanda* Iredale.
Largisipho (oligostira) spectanda nov.
Ratifusus, gen. nov.: type *Ratifusus adjunctus* Iredale.
Ratifusus adjunctus sp. nov.
Xenotrophon gen. nov.: type *Xenotrophon euschema* Iredale.
Xenotrophon euschema sp. nov.
Enixotrophon gen. nov.: type *Trophon carduelis* Watson.
Emozamia gen. nov.: type *Murex licinus* Hedley and Petterd.
Enatimene gen. nov.: type *Trophon simplex* Hedley.
Litozamia gen. nov.: type *Peristernia rudolphi* Brazier.
Gemixystus gen. nov.: type *Trophon laminatus* Petterd.
Apixystus subgen. nov.: type *Trophon stimuleus* Hedley.
Benthoxystus gen. nov.: type *Trophon columnarius* Hedley and May.
Ollaphon gen. nov.: type *Trophon molorthus* Hedley and May.
Anatrophon gen. nov.: type *Trophon sarmentosus* Hedley and May.
Gatliffena gen. nov.: type *Donovania fenestrata* Tate and May.
Tolema gen. nov.: type *Purpura sertata* Hedley.
Mathildona gen. nov.: type *Mathildona euglypta* Iredale.
Mathildona euglypta sp. nov.
Charilda gen. nov.: type *Mathilda rosæ* Hedley.
Eucharilda gen. nov.: type *Mathilda elegantula* Angas.
Opimilda gen. nov.: type *Mathilda decorata* Hedley.

TWO NEW SNAKES FROM AUSTRALIA.

By

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(Figures 1-2.)

Typhlops minimus, *sp. nov.*

(Figure 1.)

Head rounded and blunt. Snout evenly rounded. Nostrils inferior, the nasal cleft median, extending a little beyond the nostril and in contact with the second labial. Rostral more than half as wide as the head from above, and extending backwards to the level of the eyes; it is sub-circular, the sides evenly curved and rounded posteriorly; from the lower aspect it is about as broad as long. Scales in 16 rows round the body. Total length 170 mm., width of body about 2½ mm.

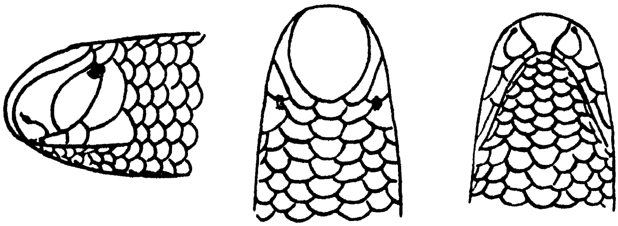

Figure 1.
Typhlops minimus, sp. nov.

Colour.—Head and tail, or tail only, dark brown, almost black. Body yellowish-brown, distinctly striated with dark longitudinal lines.

Locality.—Groote Eylandt, Gulf of Carpentaria, North Australia. Described from three specimens collected by the Rev. H. E. Warren during December, 1928. The paratypes do not vary from the holotype.

Affinity.—*T. minimus* is closely related to *T. guentheri* Peters, but differs mainly in having fewer scales round the body, and in the shape and relative size of the rostral shield.

Holotype in the Australian Museum, Reg. No. R. 9692; paratypes, Reg. No. R. 9693, 2 specimens.

RHYNCHŒLAPS CAMPBELLI, *sp. nov.*

(Figure 2.)

Snout prominent, shovel-shaped, obtusely pointed from above, the lateral edges very sharp. Rostral broader than deep, its upper portion forming an acute angle posteriorly, which is wedged deeply between the internasals: it is as long as its distance from the frontal. Internasals broader than deep, a little smaller than the prefrontals, which are also broader than deep. Frontal shorter than its distance from the end of the snout, shorter than the parietals but longer than the suture between those shields. It is more than three times as wide as the supraoculars, which are very small. The nasal is semi-divided, the division being from the nostril to the lower half of the shield. There are five upper labials, the third and fourth entering the eye; two postoculars;

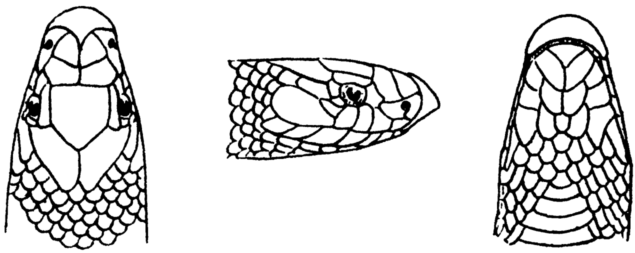

Figure 2
Rhynchœlaps campbelli, sp. nov.

one preocular; temporals 1 1. There is a small shield wedged between the fourth and fifth labial and the lower postocular, but it does not reach to the lip. Three lower labials are in contact with the anterior chin-shield, which is about as large as the posterior.

Ventrals 153; subcaudals 18 pairs; scales 17 rows; anal divided. Total length 140 mm.

Colour (in spirits).—Straw coloured above with a brown blotch on the head, a broad one 8 scales deep on the neck, and about thirty narrow, oblique, and irregular ones across the dorsal surface of the body and tail. The lower parts are whitish.

Locality.—A single specimen from Almaden, Queensland, collected in December, 1928, by Mr. W. D. Campbell, after whom it is named.

Holotype in the Australian Museum, Reg. No. R. 9387.

Affinity.—*R. campbelli* appears to be most closely related to *R. fasciolatus*, the Western Australian species, but differs in having a semi-divided nasal, which is in contact with the preocular.

Key to the species of RHYNCHOELAPS

Scales in 15 rows.
- Temporals 1 + 1; dark cross bars on dorsal surface .... *bertholdi*
- Temporals 2 + 2; a reticulate pattern on dorsal surface ..... *fuscicollis*

Scales in 17 rows.
- Nasal semi-divided.
  - A shield between the 4th and 5th upper labials . ... *campbelli*
- Nasal entire.
  - Nasal not in contact with preocular .... *fasciolatus*
  - Nasal in contact with preocular.
    - Frontal longer than broad, twice as broad as supraocular .... *australis*
    - Frontal as broad as long, at least thrice as broad as supraocular .... *semifasciatus*

R. fasciolatus and *R. bertholdi* are restricted to south-west Australia.

R. fuscicollis is known only from north-east Queensland.

R. campbelli, of which there is only one specimen, is from central Queensland. *R. semifasciatus* is a Western Australian species, and *R. australis* is known from the eastern parts of Queensland and New South Wales.

A NEW FRUIT-BAT (*PTEROPUS RAYNERI* GROUP) FROM THE SOLOMONS.

By

ELLIS LE G. TROUGHTON,

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For several months in 1927 Mr. G. A. V. Stanley, B.Sc., then Demonstrator in Geography at the University of Sydney, was stationed on Rennell Island, where he was sent by the University, at the request of the British Government, to study the geology of that remote and seldom visited locality. Consulted by Mr. Stanley regarding tropical conditions and equipment, I suggested that he might take a collecting can on behalf of the Trustees of the Australian Museum, with a view to securing mammals, birds and reptiles from a locality otherwise inaccessible to the Museum's resources.

After some very natural hesitation, actuated by the difficulties of landing, and uncertainty as to camping conditions and the attitude of the natives, Mr. Stanley very kindly agreed to add to his gear a large can of spirit for general collecting purposes.

Amongst the small but interesting collection subsequently received was a single adult fruit-bat which proved of exceptional interest in regard to its group affinities, and shows characters warranting its description as a new species.

PTEROPUS RENNELLI *sp. nov.*

Diagnosis.—Similar to *Pteropus cognatus* Andersen 1908, of San Christoval, the extreme eastern species of the *rayneri* group, which is characterised by the uniformly brownish back and light mantle, as opposed to the tricoloured backs of others of the group; also similar in having the coronoid height of the mandible slightly more than the length of c-m_3, instead of definitely less.

Differentiated from *cognatus* by the comparatively longer rostrum, and smaller tooth-rows (markedly shown in the reduced size of m^1); also by having the tibia very sparsely, instead of thickly clothed above, and entirely naked below, instead of hairy for its proximal half. The marked elongation of the 2nd-5th metacarpals apparently also distinguishes it from *cognatus*, while the

crown and sides of the head are lighter than, instead of being similar to, the back. Forearm, adult female, 121 mm. Habitat: Rennell Island, off the Eastern Solomons.

Skull.—Rostrum comparatively longer and narrower than in *cognatus*, the holotype having a greater rostral length than that of an adult *cognatus* which has a greater palation to incisive foraminal length (see measurements, p. 197); the front of the orbital cavity approximately vertically above the front of m^1, instead of above the posterior half of p^4 as in *cognatus*. Coronoid height (25·8 mm.) of the mandible definitely longer than the lower tooth-row (c-m_3 24 mm.), instead of being about subequal as in *cognatus*. Sagittal crest well developed and high anteriorly.

Dentition.—Upper and lower rows smaller than in *cognatus*, the premolars and molars of both series of the adult female being individually shorter and narrower than the minimum dimensions of two, presumably, immature males, listed for the allied species by Andersen (see measurements, p. 197), excepting only in the widths of m^2 and p^1, which are subequal in the two forms. The length (4·8 mm) and width (2·5 mm.) of m^1 displays the greatest reduction in comparison with the length and width (5·6 and 3 mm.) of that tooth in the immature males of *cognatus*, the difference being exemplified by the relative dimensions across m^1 externally in the two forms. The considerable reduction of m noted for *cognatus* by Andersen, is even more pronounced; m^2 is also more reduced in comparison with the allied species, in which the tooth is described as being slightly smaller than in *Pt. hypomelanus*.

Palate-ridges.—Arrangement as in *Pt. rayneri*, without special modifications, and presumably as in *cognatus*. Formula, 5 + 5 + 3.

Digits and other external characters.—The metacarpals of all digits are remarkably elongate, and it is unfortunate that Andersen did not record the digital dimensions of *cognatus* (apparently because of immaturity) as there is little doubt that the relative proportions of the 2nd-5th metacarpals would further separate the allied forms. For example, Andersen stated that *cognatus* was "probably smaller than *Pt. rayneri*," estimating the adult forearm as "at least 121 mm.", whereas the fully adult female *rennelli* with a forearm of 121 mm. has a 2nd digit metacarpal length of 69 mm. compared with 70 mm. for the maximum-sized specimen of the much larger *rayneri* with a forearm of 140·5 mm. Similarly, the length of the 3rd metacarpal of the holotype is subequal to the maximum length given for that metacarpal in *rayneri*; the lengths of the 4th and 5th metacarpals are intermediate between the extremes listed for the much larger species.

Ear comparatively long, well exposed, narrowly rounded off at the tip and the outer margin faintly concave in its upper fourth;

upper half of inside naked, lower half sparsely haired; externally the inner and outer bases are hairy. Membranes arising about 17 mm. apart from sides of back.

Fur.—Adpressed on back as in *cognatus* but apparently longer, the approximate length of the hairs being 15-18 mm. as opposed to 11-12 mm.; hairs of mantle 17 mm.: shorter hairs on the belly about 11-13 mm., interspersed with longer ones of about 20 mm. Width of the furred area of the middle of the back about 60 mm., including the extension onto the wing-membranes. Tibia quite differently furred from that of *cognatus*: above it is thinly, instead of thickly clothed for the proximal two-thirds, the hairs being thicker on the membrane, on the inner side, than on the tibia; below it is entirely naked, even the distal end of the thigh being unhaired, instead of the proximal half being hairy as in *cognatus*. Humerus, above, covered with short adpressed hairs for its proximal two thirds; its lower third, the elbow, and proximal third of forearm sparsely covered with fine hairs. Below the forearm is naked, but the antebrachial membrane, and the lateral along the outer three-quarters of the forearm and between the humerus and femur has a covering of scanty but longish hairs.

Colour.—General ground colour of back an uneven tone varying between prout's and mummy brown (Ridgway, 1912), grizzled owing to the pale auburn and buffy hair-tips, and the admixture of greyish hairs, which is most pronounced immediately behind the mantle. The rump appears very slightly lighter than the middle of the back owing to an increase in the buffy tone, but it does not approach the coloration of the mantle. Mantle shining ochraceous tawny, washed with palish tawny olive, the colour deepening to cinnamon brown on the sides of the neck. Basally the fur of back is about blackish brown 3, lightened by an intermingling of prout's brown and greyish hairs; below, the basal colour is about light seal brown in the centre of the belly, becoming lighter posteriorly. General tone of undersurface prout's brown, but decidedly darker in the centre of the chest and belly, which is of a blackish vandyke shade owing to an intermingling of blackish-brown and shining, coppery, vandyke hairs; the sides are washed with shining dresden brown. Cheeks greyish-brown tinged with fawn: crown palish smoke grey washed with chamois, changing to pale honey-yellow on the nape; basal colour on crown grey intermixed with sparse brownish hairs. The sparse hairs on the upper side of the tibia are blackish-brown with the longish hairs on each side of a shining yellowish auburn. Hairs beneath membrane shining tawny russet.

The colour of the head, though doubtless subject to individual variation, is apparently quite different from that of all other species of the group; this difference is most marked in the crown, which is palish smoke grey washed with chamois as opposed to

the range shown by Andersen[1] for the group, from "tawny ochraceous" (*chrysoproctus*) to "blackish seal-brown" (*grandis*).

Measurements.—On p. 197.

Specimen examined.—One, the holotype female, No. M.4217 in the Australian Museum collection, collected and presented by Mr. G. A. V. Stanley, B.Sc.

Range.—Rennell Island, situated about 90 miles south-westward of San Christoval Island, Eastern Solomons. The species therefore occurs at the southern limit of the range of the *rayneri* group in the Solomons, the range extending westwards through the Solomons to the Moluccas.

Specific affinities.—This somewhat complex species is linked with its nearest ally *cognatus* in lacking the tricoloration of the back, which is present in all others of the *rayneri* group (variable in *chrysoproctus*), as well as in having the coronoid height slightly greater instead of less than the length of $c-m_3$. It is distinguished from *cognatus* by having the tibia sparsely instead of thickly clothed above (as in the much larger Moluccan *chrysoproctus*), and in lacking the partial furring below; also by the smaller tooth rows and marked elongation of the 2nd-5th metacarpals. The comparative reduction of the rostrum in relation to the palation to incisive-foraminal length, strangely enough, accords with that of the considerably larger *rayneri*, instead of with *cognatus*.

Group affinities.—Though the extent of the rostral reduction conforms to Andersen's definition of the *rayneri* group, the reduction of i_1, m_2, and m_3 is practically as described in *Pt. lombocensis* of the closely allied group of that name. It is noteworthy that in *rennelli* and an authentic specimen of *rayneri* the size of i_1 does not agree with the proportions cited by Andersen ($\frac{2}{3}-\frac{3}{4}$ of i_2) for their group, being smaller and more in accord with those given for the *lombocensis* group ($\frac{1}{4}-\frac{1}{3}$ of i_2), and it therefore appears that the relative bulk of the lower incisors does not supply a definite diagnostic character for either group. Andersen has stated that the shortening of the rostrum is further developed in the *lombocensis* group, but the comparative dimensions show *cognatus* to have a practically similar development of the rostrum to that of *lombocensis*. In view of this, and the occurrence of *chrysoproctus* within the range of the *lombocensis* group, it would seem that the allied groups are far more interrelated than Andersen's definition of them would suggest. However, *cognatus* is clearly distinguished from *lombocensis* by the lesser reduction of m_2, greater mandibular length, and proportion of coronoid height to length of $c-m_3$, and in having the underside of the tibia partially

[1] Andersen—Cat. Chiroptera, Brit. Mus., i, 1912, pp. 259 and 261

EXTERNAL MEASUREMENTS OF *Pteropus rennelli*, *rayneri*, and *lombocensis*.

	Pt. rennelli Holotype Adult ♀ A.M. No. M.4217	*Pt. rayneri* 3 ad. Incl. cotypes Brit. Mus.		*Pt. lombocensis* 7 ad. Incl. type Brit. Mus.	
		Min.	Max.	Min.	Max.
	mm.	mm.	mm.	mm.	mm.
Forearm	121	137·5	140·5	113	122
Pollex, total length, c.u.	53	57	63	46	50·5
,, metacarpal	12·2	11·8	12·8	10·2	11
,, 1st phalanx	25·5	29	34·2	22	25·8
2nd digit, metacarpal	69	67	70	52·5	58
,, 1st phalanx	17·5	16·7	18·7	12	14·8
,, 2nd–3rd phalanx, c.u.	14·7	13·2	15·2	13 5	15 5
3rd digit, metacarpal	92	89	92	75	81
,, 1st phalanx	63·5	68	69	51	56·5
,, 2nd phalanx	92	96·5	101	79	84
4th digit, metacarpal	87·5	85·2	90·5	72·5	79
,, 1st phalanx	52	54·2	58·5	43	47·5
,, 2nd phalanx	49·8	55	55·5	44·5	50·5
5th digit, metacarpal	94	92 5	96·8	78·5	85
,, 1st phalanx	38·5	40·2	43·7	33·5	36·5
,, 2nd phalanx	37·5	41	41·5	26·5	32·5
Ear, length from orifice	23	26	—	—	27·5
,, max. width, flattened	14·3	16	—	—	15 7
Front of eye to tip of muzzle	22·7	24	—	—	20
Lower leg	53·5	59·2	63·5	49	52
Foot, c.u.	39	40·5	—	37	41
Calcar	13	19	—	—	13·2

MEASUREMENTS OF SKULLS AND TEETH OF *Pteropus rennelli*, *cognatus*, and *lombocensis*.

	Pt. rennelli Holotype Adult ♀	*Pt. cognatus* San Christoval Skull: ad. ♂ Teeth: 1 ad. 2 imm.		*Pt. lombocensis* Skulls: 7 ad. Teeth: 7 ad. (Incl. type)	
		Min.	Max.	Min.	Max.
Skull.	mm.	mm.		mm.	mm.
Total length to gnathion	c. 58 5	—		—	55
Palation to incisive foramina	27·5	28 7		—	25 7
Front of orbit to tip of nasals	18	17		14·5	16
Width of brain-case at zygomata	21 3	22		20 2	22
Zygomatic width	33	33·2		29·7	31·2
Width across m¹, externally	16·4	18		15	17
Lachrymal width	—	13 2		11	12 5
Width across canines, externally	12·6	14		11·2	12·1
Postorbital constriction	7·3	7·2		7	8
Interorbital constriction	8·3	8·7		7·2	8 8
Width of mesopterygoid fossa	7·2	7·2		7 2	7·4
Width between p⁴–p⁴, internally	10·5	10·2		8·8	10·6
Width between cingula of canines	7 5	7		5 7	6 8
Orbital diameter	12	13		12	12 5
Mandible, length	45·3/46	47		41	42·7
,, coronoid height	25·8	26		21·2	23
Upper teeth, c–m²	21·8	23		20	21·2
Lower teeth, c–m₃	24	25·5		22·2	23·7
m¹, length	4·8	5·6	5·7	5·2	5·6
,, width	2·5	3	3·1	2·8	3
m², length	1·8	2·2	2·5	1·3	1·8
,, width	1·8	1·8	2	1·3	1 8
m₃, length	1 7	1·8	1·8	1·1	1·6
,, width	1·5	1·6	1·6	1·1	1·6

furred instead of naked. Furthermore, *rennelli* is definitely separated from *lomboccnsis* by its comparatively larger skull, with a well-developed sagittal crest, comparatively longer rostrum, relationship of the coronoid height to the length of c-m_3, and in the digital dimensions, a specimen of *rennelli* with the forearm 1 mm. shorter than the maximum of *lomboccnsis*, having the 2nd-5th metacarpals 8·5 – 11 mm. longer.

I am indebted to Mr. Stanley for the opportunity to describe this very distinct if complex species, which throws such an interesting light upon the interrelationship of its nearest allies, as well as on the closely allied *lomboccnsis* group.

EXPLANATION OF PLATE XXXVIII.

Fig. 1. *Glycymeris magnificens* Iredale, external view.

Fig. 2. *Glycymeris magnificens* Iredale, internal view.

Fig. 3. *Spondylus* (*tenellus*) *regillus* Iredale, side view.

Fig. 4. *Spondylus* (*tenellus*) *regillus* Iredale, from above.

Fig. 5. *Spondylus* (*tenellus*) *regillus* Iredale, from below.

Fig. 6. *Xenogalea spectabilis* Iredale.

Fig. 7. *Mesopeplum caroli* Iredale, lower valve.

Fig. 8. *Mesopeplum caroli* Iredale, upper valve.

Fig. 9. *Mesopeplum caroli* Iredale, side view.

G. C. Clutton, photo.

EXPLANATION OF PLATE XXXIX.

Fig. 1. *Spectamen bellulum* Angas.

Fig. 2. *Spectamen philippense* Watson.

Fig. 3. *Minolops pulcherrima* Angas.

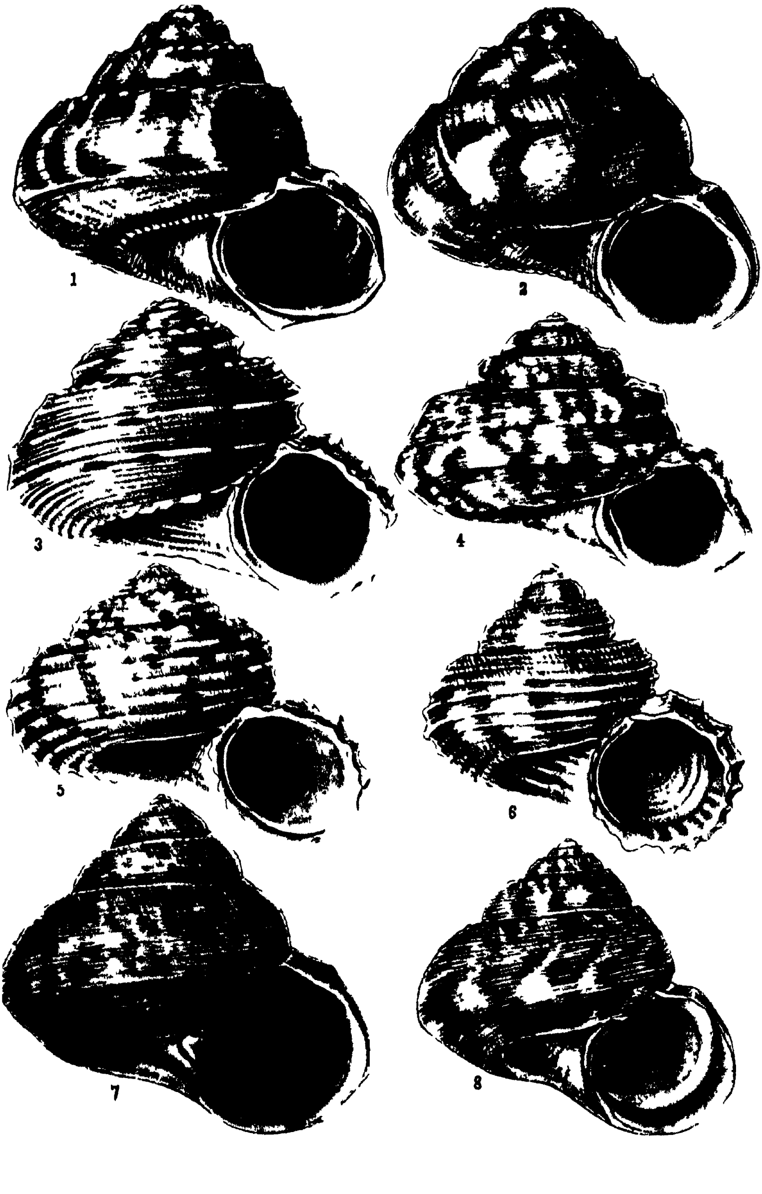
Fig. 4. *Ethminolia probabilis* Iredale.

Fig. 5. *Minolops emendata* Iredale.

Fig. 6. *Minolops arata* Hedley.

Fig. 7. *Talopena gloriola* Iredale.

Fig. 8. *Spectamen epitheca* Iredale.



Joyce K. Allan, del.

EXPLANATION OF PLATE XL.

Fig. 1. *Conus howelli* Iredale.

Fig. 2. *Cymatiella verrucosa* Reeve.

Fig. 3. *Xenotrophon euschema* Iredale.

Fig. 4. *Nannamoria amicula* Iredale.

Fig. 5. *Ratifusus adjunctus* Iredale.

Fig. 6. *Mathildona euglypta* Iredale.

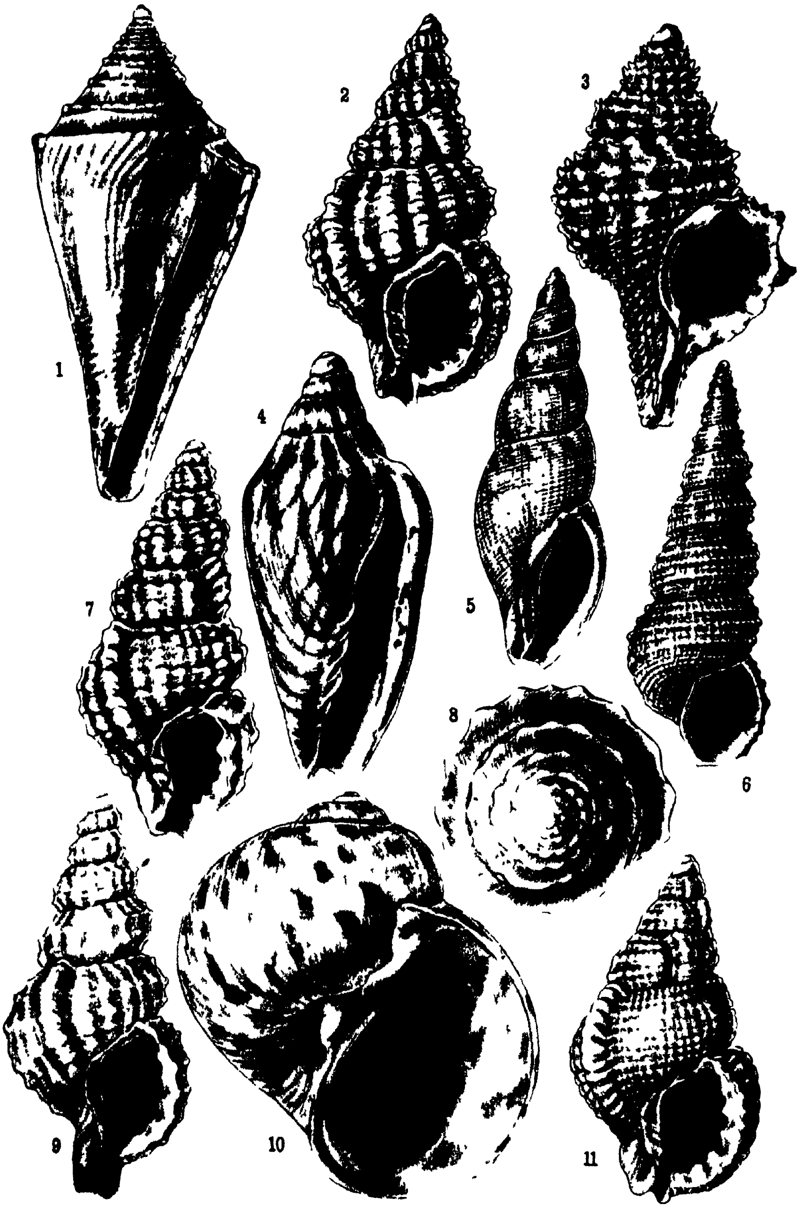
Fig. 7. *Cymatiella gaimardi* Iredale.

Fig. 8. *Conus howelli* Iredale, view of spire from above.

Fig. 9. *Cymatiella peroniana* Iredale.

Fig. 10. *Natica luculenta* Iredale.

Fig. 11. *Cymatiella lesueuri* Iredale.



Joyce K. Allan, del

EXPLANATION OF PLATE XLI.

Fig. 1. *Cymatium (spengleri) procerum* Iredale.

Fig. 2. *Cymatium waterhousei frigidulum* Iredale.

Fig. 3. *Tolema sertata* Hedley.

Fig. 4. *Mayena (australasia) benthicola* Iredale.

Fig. 5. *Charonia euclia instructa* Iredale.

Fig. 6. *Largisipho (oligostira) spectanda* Iredale.

Fig. 7. *Cymatium boltenianum* A. Adams.

Fig. 8. *Tolema sertata* Hedley.

Fig. 9. *Mesericusa sowerbyi perspecta* Iredale.

G. C. Clutton, photo.

BEES IN THE AUSTRALIAN MUSEUM COLLECTION*

By

Prof. T. D. A. Cockerell,
University of Colorado.

Family COLLETIDÆ.

Genus Goniocolletes *Cockerell.*

1907. *Goniocolletes* Cockerell, Bull. Amer. Mus. Nat. Hist., xxiii, p. 231.

Orthotype.—*G. morsus* Cockerell, 1907.

Goniocolletes morsus *Cockerell.*

1907. *Goniocolletes morsus* Cockerell, Bull. Amer. Mus. Nat. Hist., xxiii, p. 231. ♂. New South Wales.

Hab.—S. Australia. 2 ♂.

Genus Paracolletes *Smith.*

1853. *Paracolletes* Smith, Cat. Hym. B.M., pt. 1, p. 6.

I have included a series handed to me by Mr. A. J. Nicholson, of the University of Sydney, as it is more convenient to have the two lots dealt with in one place. Nicholson collected on four days in W. Australia, and obtained about 15 species of this group; not one of them identical with any species sent from the Australian Museum. This shows the extraordinary richness and variety of the fauna.

Paracolletes amabilis (*Smith*).

1879. *Lamprocolletes amabilis* Smith, Descr. New Sp. Hym., B.M., p. 9. ♀. Australia.

Hab.—Berowra, near Hawkesbury River, N.S.W., Dec. 11, 1923. 1 ♀ (T. G. Campbell).

Paracolletes amabilis *var.* rufipes *var. nov.*

A male, with the same data, is less than 8 mm. long; head dark blue green, but middle of front yellowish-green, clypeus black; antennæ entirely black; thorax dark blue-green; hair of head and

* References supplied by A. Musgrave, Australian Museum, Sydney.

thorax above fuscous; wings as in female, but nervures darker; anterior and middle knees, hind femora, and all the tibiæ and tarsi deep chestnut red; abdomen olive-green with brassy tints. This does not quite agree with *Lamprocolletes metallicus* Smith, which I have regarded as the male of *P. amabilis*. The red legs appear to separate it at once from *L. metallicus* and the hair of thorax differs. I will therefore name this male *P. amabilis* var. *rufipes* n. var., leaving it for the future to determine whether it represents a distinct race or species, and if so, whether the accompanying female, which I cannot separate from *P. amabilis*, should be associated with it.

PARACOLLETES METALLESCENS *Cockerell.*

1914. *Paracolletes metallescens* Cockerell, Ann. Mag. Nat. Hist., (8) xiv, p. 44. ♂, ♀. Yallingup, S.W. Australia.

Hab.—Eradu, W. Australia, September 8th, 1 ♀ (A. J. Nicholson). Another female, from King George's Sound (G. Masters), differs by the second cubital cell narrow, moderately contracted above, but this is probably only an individual variation. The recently described *P. semilucens* Cockerell is very like *P. metallescens*, but smaller, and especially known by the dull mesothorax without evident punctures. It is from Perth.

PARACOLLETES RUDISSIMUS *sp. nov.*

♂. Length about 7·3 mm.; black, including mandibles, antennæ, tegulæ and legs; hair of head and thorax long and abundant, pale ochreous on head and thorax above, creamy-white on face, and so dense as to cover surface (no black hair at sides); pleura with white hair; face very broad, front and vertex dull; flagellum comparatively short and thick (almost as in a female), not crenulated, apex shining; mesothorax and the broad scutellum dull, with a sort of honey-comb-like sculpture, as in *P. rudis* Cockerell; area of metathorax dullish, longitudinally plicate; wings hyaline, dusky at apex, stigma (which is slender) and nervures dark fuscous; basal nervure meeting nervules; cubital cells like those of *Nomia,* the second very small, contracted above, receiving recurrent nervure at or a little beyond middle; first very long, and third also long, strongly produced apically, receiving second recurrent about as far from end as first recurrent is from second intercubitus; legs slender, with white hair, abdomen dull, more shining beyond third segment, with little hair and no bands; hind margins of segments rather narrowly shining brown; venter shining, with a large polished basin or depression in middle of fifth sternite. The postscutellum has a distinct but low median tubercle.

Hab.—Wyalçatchem, W. Australia, Aug. 30, 1926 (A. J. Nicholson). Has much the aspect of a *Nomia,* but is related to

P. rudis Cockerell, based on a female from Swan River. It seems not to be the male of *P. rudis*, owing to various differences; yet the association is perhaps not impossible.

Paracolletes dentiger *Cockerell.*

1910. *Paracolletes dentiger* Cockerell, Trans. Amer. Ent. Soc., xxxvi, p. 199. ♀.

Hab.—King George's Sound, W. Australia. Both sexes.

Paracolletes philonesus, *sp. nov.*

♀. Length about 9·5 mm.; not very robust, black, not metallic, though it is possible to imagine that the abdomen is very obscurely blue-black; hair of head and thorax loose and grey, but greyish black on vertex and dorsum of thorax, dull white on thorax in front, on sides of metathorax and middle of mesopleura; mandibles black, dark reddish apically; malar space obsolete; clypeus convex, highly polished, with scattered rather strong punctures; supraclypeal areas polished, elevated, with few punctures; scape long, shining and black; flagellum black, with a very obscure reddish tint beneath; mesothorax polished on disc, dull at sides, hardly punctured, the dull portion appears minutely reticulate under microscope; scutellum smooth and shining; postscutellum unarmed; area of metathorax shining, dull at extreme base; tegulæ dark rufo-piceus; wings hyaline, faintly brownish; stigma and nervures dark reddish fuscous; stigma well developed but slender; basal nervure meeting nervulus; second cubital cell much contracted above, receiving recurrent nervure about middle; third cubital not much produced, receiving recurrent nervure a short distance before end (more than half distance from first recurrent to second intercubitus); legs black, the tarsi with ferruginous hair on inner side (scopa of hind legs in type full of bright orange pollen, the grains triangular and not echinate); hair of hind knee dark fuscous; abdomen bandless, the surface dull and without punctures visible under a lens (the microscope shows minute lineolation and reticulation), the hind margins of tergite shining, entirely black; apex with soot-coloured hair, venter with pale hair.

Hab.—Mt. Gower, Lord Howe Island, Jan. 19, 1922 (A. R. McCulloch). A very ordinary looking species, but it is extremely interesting to see a bee from Lord Howe Island. In my tables it runs nearest to *P. metallescens* Cockerell from W. Australia, but is smaller, with surface of abdomen dull, and not metallic. It is also very close to the New Zealand *P. boltoni* Cockerell, but smaller, with dull abdomen, and much more black hair on thorax above. In the dull abdomen it is like *P. rudis* Cockerell, but that has the base of metathorax dull.

PARACOLLETES CHRYSOSTOMUS *sp. nov.*

♂. Length about 12 mm.; black, with the mandibles fulvous, dark at apex, the labrum fulvous; scape greatly swollen and light ferruginous, flagellum short and thick, ferruginous, blackened above; legs black, small joints of tarsi rufous, anterior femora with a pale stripe in front; anterior tibiæ pale fulvous in front and on inner edge, the fulvous invading the black of the outer face in middle; abdominal tergites 2 to 5 with narrow cream-coloured tegumentary bands; apical plate broad, apically red; face and front densely covered with very brilliant orange-golden hair, but the supraclypeal area bare, with a large flattened polished impunctate surface; malar space large, shining; cheeks with very long pale yellow hair; thorax dorsally with long erect bright ferruginous hair; mesothorax and scutellum dull, without evident punctures; area of metathorax triangular, hairy, entirely dull; tegulæ black; wings hyaline, slightly greyish at apex, nervures black, stigma almost obsolete; basal nervure falling short of nervulous, first cubital cell hardly as long as the next two combined; second cubital cell much narrowed above, receiving recurrent nervure about middle; third cubital very broad above, receiving second recurrent nervure some distance from end; legs short and stout, with yellow hair, the anterior and middle tibiæ robust; middle basitarsi short and broad, with very long hair, hind basitarsi broad and parallel sided, the small joints of tarsi thick; hind femora with abundant very long yellow hair; hind tibiæ with dense creamy-white hair on inner side; first abdominal segment and middle of second with long pale fulvous hair, rest of abdomen dorsally almost nude, dull black, with fifth segment more shining, sericeous.

Hab.—Eradu, W. Australia, Sept. 8, 1926, 2 ♂ (A. J. Nicholson). This could as well be called *Anthoglossa chrysostoma*, but the exact limits of *Anthoglossa* are uncertain, as explained in Entomologist, Jan. 1906, p. 16. We may have to regard *Anthoglossa* as a subgenus of *Paracolletes*, and the present insect, with its peculiar legs and antennæ, might perhaps rank as a new subgenus. The characters of the comparatively short first cubital cell, and very broad second cubital, supposed to distinguish *Anthoglossa*, seem not to be of generic value. The male of *A. plumata* Smith, the type of the genus, while differing in venation and other characters from the species now described, agrees with it in the bright orange red hair covering the face. In my key, *P. chrysostomus* falls next to *P. marginatus* Smith, which is also an *Anthoglossa* if we accept that genus in the broader sense. *P. marginatus lucidus*, described below, differs from *A. sericea* Smith, in the dark tegulæ and the absence of "short changeable reddish pile" covering the abdomen, but in the fulvous fimbria and smooth shining clypeus with reddish margin it agrees with *A. sericea*. The accompanying male agrees with that of *P. marginatus*. It is thus evident that *sericea* and *marginatus* cannot be separated generically.

PARACOLLETES CALLURUS *Cockerell* 1914 *subsp.* NIGRIOR *nov.*

♀. Broader, with broader face; anterior part of thorax above without a broad white collar or band; wings less dusky; anterior tibiæ deep chestnut red; abdominal venter dark red, known from other species by its black tegument, with end of abdomen (including fifth segment) densely covered with very bright ferruginous hair. Mesothorax and scutellum covered with rather short black hair, pleura with long white hair.

Hab.—King George's Sound, W. Australia.

PARACOLLETES LEAI *Cockerell.*

1912. *Paracolletes leai* Cockerell, Proc. Linn. Soc. N.S.W., xxxvii, p. 597. ♀. Ulverstone, Tasmania.

Hab.—Barrington Tops, N.S.W., 20.1.1927, ♀ (T. G. Campbell); National Park, Macpherson Range, Queensland, Dec. 18, 1926, ♀ (A. Musgrave).

PARACOLLETES MARGINATUS *Smith* 1879 *var.* LUCIDUS *n. var.* or *subsp.*

The ♀ (type of var.) has the caudal fimbria fulvous, the abdominal bands whiter, the clypeus highly polished, with few scattered punctures, its apical margin reddish.

Hab.—Geraldton, W. Australia, Sept. 4, 1926, ♀, ♂ (A. J. Nicholson).

PARACOLLETES IBEX *Cockerell.*

1914. *Paracolletes ibex* Cockerell, Ann. Mag. Nat. Hist., (8) xiii, p. 138. ♂. Windsor, Victoria.

Hab.—Wyalcatchem, W. Australia, Aug. 30, 1926, ♂ (A. J. Nicholson).

PARACOLLETES REBELLIS *Cockerell.*

1912. *Paracolletes rebellis* Cockerell, Ann. Mag. Nat. Hist., (8) ix, p. 379. ♂. Victoria.

Hab.—Moonbar, 3 3,500 ft., Monaro, N.S.W., March, 1889, ♂ (R. Helms).

PARACOLLETES NICHOLSONI *sp. nov.*

♀. Length nearly 7 mm.; black, shining, with thin erect white hair; disc of mesothorax with long black or dark grey hair, but vertex and scutellum with white; hair of face all white, no black at sides; abdomen little hairy, third and fourth tergites with very thin bands of white hairs, and a little pale hair at sides of first

two; hair at apex black; legs with white hair, the scopa on hind tibiæ white, remarkably large and loose; head broad; mandibles and antennæ black; clypeus convex, shining, but with numerous punctures; area of metathorax highly polished in middle, dull at sides; mesopleura shining; tegulæ brownish black; wings hyaline, with very dark brown stigma and nervures; stigma large; basal nervure falling short of nervulus; second cubital cell narrow, receiving recurrent nervure at or beyond middle; third cubital very broad above, receiving second recurrent nervure near end; the basal nervure is conspicuously arched; legs black, slender, ordinary; abdomen very finely and inconspicuously punctured, the first tergite highly polished.

Hab.—Five from Kojarena (type locality), Sept. 6, four from Eradu, Sept. 8, one from Geraldton, Sept. 4; all in W. Australia, 1926 (A. J. Nicholson). An inconspicuous little species, easily known from *P. nanus* (Smith) by the dark antennæ and the apical margins of tergites not testaceous.

PARACOLLETES PUSILLUS *sp. nov.*

♂. Size and appearance of *P. nicholsoni*; and I was at first sure that it must be its male, but this seems impossible, because the venation is strikingly different, the basal nervure conspicuously less arched, and the small second cubital cell receiving the recurrent nervure almost at its inner corner. Instead of the thin apical hair bands on tergites 3 and 4, tergites 4 and 5 are broadly white-pruinose at base. Antennæ dark, only moderately long; mandibles black; face narrow, the sides very densely covered with snow-white hair; clypeus dullish, punctured, the apical margin broadly shining and finely punctured; mesopleura shining; anterior femora with a large red patch in front; anterior tibiæ entirely red in front, but the tarsi dark; hind legs at base with very long white hair beneath; apical plate of abdomen small and dark.

Hab.—Geraldton, W. Australia, Sept. 4, 1926 (A. J. Nicholson). Easily known from *P. scitulus* Cockerell by the entirely black middle and hind legs, and from *P. minutus* Cockerell by the dark mandibles, only reddened at extreme apex.

PARACOLLETES ADVENA (*Smith*).

1862-64. *Andrena advena* Smith, Trans. Ent. Soc. Lond., (3) i, p. 60. ♀. Australia.

Hab.—Kojarena, Sept. 6, and Eradu, Sept. 8, W. Australia, ♀ (A. J. Nicholson).

PARACOLLETES RUFIBASIS *sp. nov.*

♂. Length about 12 mm.; rather slender, black, with clypeus honey colour (black along lateral sutures); labrum and mandibles

(except sharp black apex) also honey colour; scape (not swollen) clear red; first abdominal tergite ferruginous basally, with broad black apex, and black along sides; second tergite red at base, with a variable amount of black, when (as in the type) the black is reduced to a transverse band, this is extended basad and angulate in middle, and there are rounded black marks at extreme sides; hind margins of tergites pale golden, narrowly on first, broader on the others, these golden bands very thinly covered with glistening white hair; basal half of venter largely light red. Face broad, eyes prominent, not hairy; face and front densely covered with long orange-golden hair; cheeks with long pure white hair; flagellum long, obscurely reddish beneath, normal at apex; vertex dull; thorax above (including tubercles) with fulvous hair, at sides and on metathorax with white hair, contrasting; mesothorax and scutellum dull, without evident punctures; area of metathorax dull hairy; pleura dull; tegulæ dusky testaceous; wings hyaline, slightly dusky; stigma nearly obsolete, nervures dark; basal nervure falling a little short of nervulus; second cubital cell broad below, receiving recurrent nervure in middle; third cubital much broader above than second, receiving second recurrent nervure some distance from end; femora black (anterior pair red in front), knees, tibiæ and tarsi bright ferruginous; middle femora very broad; hind tibiæ with silky white hair on inner side; hind basitarsi with creamy white hair on inner side; hind spurs short and pale; the second abdominal segment, seen from above, shows short white pile at the sides.

Hab.—Two from Eradu, W. Australia, Sept. 8, 1926 (A. J. Nicholson). Runs in my table next to *P. callander* Cockerell, but easily separated by the colour of the abdomen. This is another species which might be placed in *Anthoglossa,* and it has the relatively short first cubital cell. It is also related to *Andrenopsis flavorufus* Cockerell, which has only two cubital cells.

PARACOLLETES CARINATUS (*Smith*).

1853. *Lamprocolletes carinatus* Smith, Cat. Hym. B.M., i, p. 11. ♀. New Holland.

Hab.—Tasmania. Two females.

PARACOLLETES PLUMOSUS (*Smith*).

1853. *Lamprocolletes plumosus* Smith, Cat. Hym. B.M., i, p. 12. ♀. Swan River.

Hab.—Geraldton, W. Australia, Sept. 4, 1926, 3 ♀, 1 ♂ (A. J. Nicholson). Smith described the same species as *bicolor*. The Geraldton male has the tarsi and a large part of the tibiæ red, as Smith indicates for *bicolor*.

PARACOLLETES MEGACHALCEUS *Cockerell.*

1913. *Paracolletes megachalceus* Cockerell, Ann. Mag. Nat. Hist., (8) xii, p. 374. ♀. Clarence River, N. S. Wales.

Hab.—Raymond Terrace, near Newcastle, N.S.W. ♀ (A. F. D'Ombrain). The specimen is in bad condition with the dorsal hair of thorax rubbed off. A feature of this species is the prominent tubercle on the supraclypeal area.

PARACOLLETES CHALYBEATUS (*Erichson*).

1842. *Andrena chalybeata* Erichson, Arch. f. Naturg., viii, i, p. 268. ♀.

Hab.—♀. Jindabyne, N.S.W.; 3,000 ft., March, 1889 (R. Helms); Tasmania. This is *P. providus* (Sm.), and is not the species which Smith identified as *chalybeatus.*

PARACOLLETES DIODONTUS *sp. nov.*

♀. Length about 13 mm.; head broad, dark blue, with clypeus and supraclypeal area black; mandibles black; clypeus broad and low, rugosopunctate, glistening; antennæ black; face, cheeks and occiput with long white hair, vertex with black hair; thorax black, with anterior (broadly) and posterior margins of mesothorax green; scutellum greenish; pleura dark blue; mesothorax and scutellum shining, with scattered punctures; postscutellum with a very large median bidentate process, on the under side of which is long pure white hair; area of metathorax short, smooth and polished; tegulæ black; wings dilute fuliginous, pallid basally, stigma and nervures very dark, stigma small but not obsolete; basal nervures meeting nervulus, second cubital very broad, receiving recurrent nervure at or a little before middle; third cubital not quite as broad above as second, receiving second recurrent near end; legs black, with white hair on femora, black on tibiæ and tarsi; scopa of hind tibiæ large, black on outer side, pure white on inner; abdomen black, with first segment greenish basally, the very broad depressed margins of the segments beautifully green; on first segment bluish green, on the other yellowish green; apex with a large brush of black hair, venter with much pure white hair, and fourth segment with a very thin band of white hairs; second and third segments before the margin dull and very finely punctured, fourth and fifth with more distinct punctures.

Hab.—Two from Eradu, W. Australia, Sept. 8, 1926 (A. J. Nicholson). Closely related to *P. vigilans* (Smith), but separated by the metallic head, green-banded instead of green abdomen, flagellum not fulvous beneath, and darker wings. *P. subvigilans* Ckll. is also a similar species, but the process on postscutellum is quite different.

PARACOLLETES ROBUSTUS *sp. nov.*

♀. Length 12·3 mm.; black, very robust, head and thorax with long white hair, black on vertex, and broadly tipped with black on thoracic dorsum; mandibles black, broadly rufescent apically; malar space linear; sides of face with long white hair, and no black; flagellum obscurely rufescent beneath; face very broad; clypeus shining but densely punctured; supraclypeal area polished, with a few punctures; mesothorax and scutellum dull, with small punctures; postscutellum unarmed; area of metathorax somewhat shining, but not polished; tegulæ obscure reddish; wings brownish, nervures reddish fuscous; stigma almost obsolete; basal nervure falling a little short of nervulus; second cubital cell very broad, receiving recurrent nervure about middle; first cubital shorter than the other two combined; third cubital receiving second recurrent nervure very near its end; legs black, small joints of tarsi red, and anterior tibiæ in front; and hind tibiæ and basitarsi entirely dark red; scopa of hind tibiæ shining white; abdomen broad, dull, with extremely minute punctures; margins of second to fourth tergites with narrow thin glistening white hair bands; hair at apex black; venter with much white hair.

Hab.—Two from King George's Sound, W. Australia. Runs in my key exactly to *P. tenuicinctus* Ckll., and at first sight appears to be that species, but it is easily distinguished by the very broad apical plate of abdomen, which has no median raised line, and the perceptibly narrower face. The clypeus is less coarsely and densely punctured, and so more shining. *P. adrena* (Smith), also related, has the apical plate of abdomen narrow, with converging sides, but there is no raised line.

PARACOLLETES PHANERODONTUS *sp. nov.*

♀. Length 14·3 mm.; head and thorax black, but disc of mesothorax suffused with green; mandibles black; flagellum obscurely reddish beneath toward apex; legs black; abdomen shining steel blue, without spots or bands, the apical hair black; head and thorax with long white hair, rusty black on vertex, disc of mesothorax, and scutellum, but a band of white between mesothorax and scutellum; postscutellum with a stout sharp spine. Malar space very short; clypeus dullish, strongly punctured, slightly green; sides of front dull, but a polished space behind each lateral ocellus; mesothorax and scutellum shining, with rather sparse distinct punctures; area of metathorax shining, the transverse carina obtuse; tegulæ piceous; wings clear, very faintly brownish, stigma and nervures dark reddish brown; stigma small but distinct; basal nervure meeting nervulus; second cubital cell broad, receiving recurrent nervure much before middle; third cubital receiving second recurrent a moderate distance from end; abdomen polished, hardly punctured; venter with white hair. Tibial scopa white on inner side.

Hab.—King George's Sound, W. Australia. Related to *P. subvigilans* Ckll., but the abdomen is differently coloured and the wings are much clearer. It may perhaps rank as a subspecies, but the appearance is very different. From *P. dentiger* Ckll. it is easily known by the smooth polished abdomen.

PARACOLLETES PAVONELLUS *sp. nov.*

♀. Length about 9·3 mm.; head dark green, with clypeus and supra-clypeal area black; thorax dull black, the mesothorax greenish in anterior middle; pleura faintly greenish; legs black with hind tibiæ (except base above) and tarsi clear ferruginous; abdomen beautiful peacock green with a dullish sericeous surface, the apical depressions of tergites black. Mandibles black, rufus at apex; malar space large, polished; clypeus shining but well punctured, flattened in middle; flagellum obscure reddish beneath; hair of head and thorax long, dull white, black on vertex and thoracic dorsum; mesothorax and scutellum dull, without evident punctures; post scutellum unarmed; area of metathorax somewhat shining; tegulæ dark rufous; wings brownish hyaline, stigma and nervures dark brown; stigma small but distinct; basal nervures meeting nervulus; second cubital cell broad, receiving recurrent nervure distinctly before middle; third cubital receiving second recurrent a moderate distance from end; hind tibial scopa pale clear reddish, some black hairs just below knee; hind basitarsi slightly dusky apically; abdomen without hair bands; apical hair black, but scanty; apical plate very large and broad; venter with long pale reddish hair on middle of second segment, and short hair on those beyond.

Hab.—King George's Sound, W. Australia. Runs in my table next to *P. viridicinctus* Ckll., but the abdomen quite differently coloured. In the colour of the abdomen it resembles *P. boroniæ* Ckll., which is much larger, with quite different tibial scopa. There is also some resemblance to *P. amabilis* (Smith).

PARACOLLETES VELUTINUS *sp. nov.*

♂. Length about 11 mm.; black, slender wings unusually short, anterior wing about 7 mm.; hair of head and thorax long, fulvous, rich and bright on face and thoracic dorsum, becoming whitish on cheeks and under side of thorax; head broad, face broad, but eyes distinctly converging below; mandibles black, malar space obsolete; scapa long and black; flagellum slender, reaching as far as base of wings, clear ferruginous beneath; mesothorax moderately shining, not evidently punctured, the disc highly polished; scutellum broad and rather flattened, moderately shining, with a slight median sulcus; area of metathorax highly polished; tegulæ obscure rufous; wings clear; stigma very narrow, with dark margin; nervures dark fuscous; basal nervure meeting nervulus; second cubital cell very broad, receiving recurrent nervure much before middle; third cubital

receiving second recurrent a moderate distance from end; legs slender with long yellow hair; more than apical half of anterior femora, their tibiæ and tarsi entirely, apex of middle femora, middle tibiæ in front and behind, hind tibiæ in front, and middle and hind tarsi, all bright ferruginous; abdomen shining, very minutely punctured, hind margins of segments not discoloured; first two tergites covered all over with thin erect pale fulvous-tinted hair; tergites 3 to 5 with a very broad basal band (variously overlapped by the segment before) of fine pale brown velvet-like tomentum; venter polished, with little hair, but hind margin of fourth sternite with a fringe of bright red hair.

Hab.—Eradu, W. Australia, Sept. 8, 1926 (A. J. Nicholson). Runs in my table to the vicinity of the much smaller *P. abnormis* Ckll., but also suggestive of *P. aurescens* Ckll., *P. aurifrons* Smith, and *P. colletellus* Ckll. The last resembles it in the tomentose bases of the tergites, but is smaller and different in various ways.

PARACOLLETES HELMSI *sp. nov.*

♂. Length about 12 mm.; slender, head and thorax black, with a very slight greenish suffusion on mesothorax; abdomen blue green, moderately shining, not evidently punctured, but microscopically reticulate; hair of head and the thorax long, abundant and erect (long and outstanding on face), dull whitish, but dark fuscous on vertex, upper part of sides of face, and (more grey) on scutellum and adjacent parts; face very broad; mandibles black, obscurely reddened apically; malar space well developed; clypeus dull, closely punctured, shining between the punctures apically; antennæ entirely black; flagellum long but rather thick, the sutures impressed; mesothorax dull, shining on disc, weakly punctured; scutellum with a slight median groove, on each side of which it is shining; area of metathorax dull; mesopleura dull; tegulæ rufotestaceous, not brightly coloured; wings ample, hyaline, stigma and nervures ferruginous; stigma large; basal nervure almost meeting nervulus; second cubital cell broad below, narrower above, receiving recurrent nervure about the middle; legs mainly reddish-black, with thin, long pale hair, all the tarsi clear chestnut red; anterior tibiæ clear red in front, hind tibiæ distinctly reddened; abdomen without bands; hair at apex grey.

Hab.—Kosciusko, N.S.W., 5,000 ft., March, 1889 (R. Helms). Runs in my table next to *P. castaneipes* Ckll., which has the face covered with appressed silvery hair. It is really more like a large edition of *P. chalybeatus* (Erichs.), with much dark hair on head and thorax. No doubt it is a mountain form.

PARACOLLETES CARINATIFRONS *sp. nov.*

♀. Length about 10·4 mm.; black, with the depressed hind margins of the abdominal segments lively rufous, and the last

antennal joint bright ferruginous below; mandibles dark red apically; disc of clypeus forming a polished basin, with a median keel, which extends upward to middle ocellus; hair of cheeks and under side of thorax white; face with white hair on each side, not dense; vertex and dorsum of thorax with thin rusty coloured hair, more blackish on scutellum; stigma slender but well developed, rich chestnut red; basal nervure meeting nervulus; second cubital cell very broad, receiving recurrent nervure a little beyond middle; third cubital very broad above, shaped about as in *P. incanescens*, but broader above; anterior basitarsi on inner side with long very bright copper red hair. Runs in my key to *P. incanescens* Ckll., to which it is very closely allied, differing thus: narrower and less robust, the abdomen conspicuously narrower with hind margins of tergites red; area of metathorax transversely striate (as in *P. perpolitus* Ckll.); tegulæ rufous; hair of tubercles and sides of thorax all white; wings browner. It is close to *P. perpolitus* Ckll., based on the male from W. Australia, but the wings differ, and considering the very different locality it does not seem possible that it is the female of *P. perpolitus*. *P. speculiferus* Ckll. is also allied.

Hab.—Sydney, N.S.W. (C. Gibbons). K49023.

PARACOLLETES ALBOVITTATUS *sp. nov.*

♀. Length about 9 mm.; black, shining, the hind margins of the abdominal tergites obscurely brown; hair of head and thorax long and loose, rather dull white (a broad band of white hair on each side of face), on vertex, disc of mesothorax and scutellum stained with pale brownish; mandibles black; malar space obsolete; clypeus extremely densely punctured, with a smooth median line, well developed only on upper half; supraclypeal area prominent and shining in middle; antennæ black, the flagellum very faintly brownish beneath; front and vertex shining; mesothorax and scutellum highly polished, with sparse small punctures, numerous along hind margin of scutellum; area of metathorax polished and shining; posterior truncation strongly concave, forming a basin; pleura shining; tegulæ brownish black; wings brownish; stigma rather small and narrow, dark reddish; nervures dark fuscous; basal nervure falling short of nervulus; second cubital cell broad below, narrower above, receiving recurrent nervure before the middle; third cubital receiving second recurrent a moderate distance from end; legs, black with mainly pale hair, whitish even on inner side, of tarsi; hind tibial scopa white, some black hair below knees (pollen collected round end spinulose, doubtless of Compositæ); abdomen broad, highly polished, but sides and bases of tergites duller; first three segments with a lateral elevation before the depression; segments 2 to 4 with rather broad pure white hair bands, broadly interrupted on 2 and 3, entire on 4; apical tuft large, dark chocolate colour, a tuft of white hair at each extreme side; venter with white hair.

Hab.—Eradu, W. Australia, Sept. 8, 1926 (A. J. Nicholson). In my table it runs to *P. subviridis* Ckll., but the abdomen is not at all greenish, and the hair bands are much wider than in *P. subviridis* or the related *P. adrena* (Sm.). It is a unique little species.

PARACOLLETES OPACULUS *sp. nov.*

♀. Length about 9 mm.; rather robust, black, the abdomen very faintly greenish; hair of head and thorax white, pure white at sides of face, long and white on vertex very scanty, with a few scattered dark hairs, on thoracic dorsum; mandibles black; malar space linear; clypeus flattened, dull, very densely and rather coarsely rugosopunctate; supraclypeal area very densely punctured at sides, with a little shining space in middle; front dull; flagellum with apical part strongly reddened beneath; mesothorax and scutellum entirely dull without evident sculpture, but the microscope shows excessively dense, contiguous, minute punctures; area of metathorax dull, with a median transverse elevation; mesopleura dull; tegulæ piceous, very dark; wings dilute brownish, stigma and nervures piceous, stigma small but distinct; basal nervure just falling short of nervulus; second cubital cell narrowed above, receiving recurrent nervure about middle; third cubital receiving second recurrent very near end; postscutellum with a small tubercle; legs black, with pale hair, anterior knees rufescent; the hind femora and tibiæ in type carry a large amount of very bright reddish-orange pollen; middle basitarsi broadened; abdomen broad, dull, without hair-bands, the hind margin of third segment testaceous, the margin of fourth with a little pale hair; under the microscope the surface of the abdomen shows very minute piliferous punctures; hair of fifth and sixth segments greyish-black, with white at each side of fifth; venter with white hair.

Hab.—Geraldton, Sept. 4, 1926 (A. J. Nicholson). Runs to *P. tuberculatus* Ckll., but easily known by the rough opaque clypeus. Also related to *P. obscuripennis* Ckll.

PARACOLLETES FRIESEI *Cockerell.*

1929. *Paracolletes friesei* Cockerell, Amer. Mus. Novit. No. 343, 8th March, 1929, p 2.

1929. *Paracolletes friesei* Cockerell, Mem. Queensland Mus., ix, 3, 29th June, 1929, p. 306. ♀. King George's Sound, W.A. (Full description.)

Hab.—Female. King George's Sound, W.A. Topotype. The thorax has bright red hair above, but the cheeks, pleura and metathorax have white hair; abdomen shining steel blue shading into green; vertex with sooty hair.

Genus ANDRENOPSIS *Cockerell.*

1905. *Andrenopsis* Ckll., Trans. Amer. Ent. Soc., xxxi, p. 363.

ANDRENOPSIS VELUTINUS *sp. nov.*

♀. Length about 6 mm., head and thorax black, abdomen black and chestnut red; first tergite dull black with the hind margin broadly red; second the same; third red with a very large transverse black patch, and a black spot at each extreme side; fourth similar, but the black patch not so well defined; hind margin of fourth pale yellowish, almost golden; fifth reddish with dusky apex; no hair bands, but much pure white hair beneath. Mandibles dark, faintly reddish subapically; face very broad, with thin white hair; clypeus somewhat shining with scattered large punctures; antennæ entirely dark; scape long; flagellum short and subclavate; mesothorax and scutellum dull; thorax dorsally and tubercles covered with short velvety yellow-brown hair; area of metathorax somewhat shining, without distinct sculpture (the microscope shows very minute punctures, as dense as possible, confluent in lines); tegulæ dark rufopiceous; wings greyish hyaline; stigma fairly large, dark reddish; nervures fuscous; basal nervure meeting nervulus; only two cubital cells, the first longest; first recurrent nervure joining second cubital cell very near base, second more remote from apex; legs black, with silvery white hair; anterior and middle knees red; apical plate red, broadly truncate. The claws have an inner tooth, and the hind tibial scopa is loose and beautifully plumose.

Hab.—Kojarena, W. Australia, Sept. 6, 1906 (A. J. Nicholson). The second species of the genus, easily known by its much smaller size.

ANDRENOPSIS FLAVORUFUS *Cockerell.*

1905. *Andrenopsis flavorufus* Ckll., Trans. Amer. Ent. Soc., xxxi, p. 364. ♂. Australia.

Hab.—Sydney, N.S.W., two males (C. Gibbons, K49004). Previously known only from the unique type in the British Museum, labelled "Australia." The mouthparts have not been described, but it can now be said that the maxillary palpi are slender, six-jointed, the first short and stout, the next four longer and about equal in length, but successively more slender, the last longer and very slender; mentum very long; labial palpi four-jointed, first joint stout, second about as long, but more slender, third stoutest, fourth slender and longest; tongue colletiform, short and deeply emarginate. Nothing is known of the habits of this genus, and the female is unknown.

Family PROSOPIDIDÆ.

Genus EURYGLOSSA *Smith.*

1883. *Euryglossa* Smith, Cat. Hym. B.M., pt. 1, p. 17.

EURYGLOSSA FLAVOPICTA *Smith.*

1879. *Euryglossa flavopicta* Smith, New Sp. Hym., B.M., p. 14. ♀, Champion Bay, W.A.

Hab.—King George's Sound (G. Masters). ♀. This pretty little species is subject to variation, and it may be that more material will indicate racial groups. The present specimen differs from one from Brisbane in having a black stripe at each side of upper part of clypeus, the discal yellow stripes on mesothorax not connected by a cross stripe posteriorly, the scutellum with a large central black mark, the area of metathorax entirely black, and the stigma pale orange.

The Brisbane insect (Mem. Queensland Mus., v, 1916, p. 199) may stand as variety *ornatula* n. var. The stigma is hyaline in middle with a broad very dilute sepia margin; there is a transverse band connecting the yellow discal stripes of mesothorax posteriorly. A very closely related form is *E. euxantha* Perkins, from Port Darwin, which differs in the details of the markings, having, however, the cross band connecting the yellow stripes on mesothorax posteriorly. It has the front of the head below the ocelli dull, whereas in *ornatula* it is shining, and it lacks the two large black clairform stripes descending from the lateral ocelli down the front in *ornatula*.

EURYGLOSSA CAMPBELLI *sp. nov.*

♀. Length about 7 mm., not very robust; black, with pale yellow markings, the yellow parts being the mandibles, labrum, clypeus (except a small spot at each side), broadly triangular supraclypeal mark (separated by a black line from clypeus), band-like parallel-sided lateral face-marks along orbits (ending obliquely, the point mesad, some distance above level of antennæ); narrow line going down front from middle ocellus; small spots at base and apex of scape, broad band behind eyes, borders of pronotum, and all of tubercles, narrow lateral margins of mesothorax, scutellum, axillæ, postscutellum, broad transverse band just below wings, sides of thorax posteriorly anterior trochanters, much of apical part of their femora, their tibiæ except a black stripe on outer side, middle trochanters, their femora, except a black keel below and an apical dot behind, their tibiæ in front, hind trochanters, their femora except a small apical mark, large triangular mark on each side at base of second abdominal tergite, large transverse marks (incised behind at margin) at lateral bases of third and fourth segments, much smaller marks at sides of fifth. Venter and hind tibiæ black; tarsi dull reddish; face broad; front dull; flagellum ferruginous beneath; mesothorax and scutellum dull, the latter with two faint spots; base of metathorax dullish; tegulæ dull reddish; wings dusky hyaline; stigma dilute brown, with darker margin, nervures pale; first recurrent nervure joining second cubital cell a short distance from base; abdomen moderately shining; apical plate very narrow.

Hab.—Almaden, North Queensland, April 25, 1928 (W. D. Campbell). A distinct species, something like *E. quadrimaculata* Smith, but easily distinguished by the markings. The hind tibiæ have short pale hair, but no scopa.

EURYGLOSSA RAINBOWI *sp. nov.*

♀. Length about 8 to 8·3 mm.; robust, with broad abdomen; head and thorax shining black, with little hair; mandibles black; flagellum rather narrowly ferruginous beneath except at base; face broad, convex, very highly polished, the clypeus with a few scattered punctures, the supraclypeal area with none; front polished, with widely scattered punctures; cheeks small; mesothorax dullish anteriorly, posteriorly polished, hardly punctate (the microscope shows a tessellate surface and scattered very small punctures): scutellum like disc of mesothorax; area of metathorax shining, but not polished, the surface microscopically tessellate; mesopleura with rather large punctures; tegulæ piceous, posteriorly pallid; wings dusky hyaline; stigma ferruginous with dark margin, nervures dark fuscous; a rather faint cloud at apex of wing; basal nervure falling short of nervulus; second cubital cell very large, receiving recurrent nervures about equally far from base and apex; legs black, with thin pale hair, but anterior and middle knees pale, anterior tibiæ broadly pale reddish (a sort of honey colour) in front; all the tarsi very obscurely reddish; abdomen broad, dullish, dusky or clear red, not banded; the tergites are more or less dusky in middle, especially posteriorly, and at the extreme sides are heavily blackened, the black areas alternating with pallid ones; venter red suffused with blackish.

Hab.—Blackwood, South Australia, Nov., 1912. 2 ♂ (W. J. Rainbow). Close to *E. edwardsii* Ckll., but without the patches of white hair seen in that species.

EURYGLOSSA AUREOPICTA *sp. nov.*

♀. Length about 7 mm.; robust; head and thorax black, dullish, the punctures excessively minute; mandibles castaneous, darker apically; clypeus black, polished, sparsely punctured; lateral face marks large, orange (reddened by cyanide in type), shaped like stout feet on tip-toe, filling space between clypeus and orbits, ending broadly above about half way up front, and widely separated from orbits; hair of head and thorax thin, greyish; scape entirely bright orange; flagellum ferruginous, dusky above; area of metathorax dull, without evident sculpture (the microscope shows excessively fine transverse lineolation); tegulæ and a pair of conical callosities at base of anterior wing opaque very bright orange-yellow; tubercles large, orange; wings hyaline, slightly milky, stigma dark reddish; second recurrent nervure meeting outer intercubitus; legs very dark reddish brown, with pale hair, ends of tarsi clear red; abdomen broad, dull, obscurely bluish-green, the hind margins of the segments piceous.

Hab.—King George's Sound, W.A. Easily known by the opaque bright orange tegulæ and orange scape.

Genus Euryglossidia *Cockerell.*

1910. *Euryglossidia* Cockerell, Ann. Mag. Nat. Hist., (8) vi, p. 358.

Euryglossidia cyanescens *sp. nov.*

♀. Length about 5·5 mm.; head and thorax black, with thin white hair; abdomen with first three segments very bright ferruginous red, with a faint purple lustre, the second tergite with an oval black spot on each side; remaining tergites dark with a strong bluish or blue-green lustre, the apical tuft of hair black; mandibles reddened apically; flagellum thick (subclavate), bright ferruginous beneath; face very broad, with thin white hair; clypeus somewhat shining, finely punctured; supraclypeal area highly polished, brilliant; front dull; mesothorax and scutellum closely punctured, shining between the punctures; postscutellum shining; area of metathorax dull, with very delicate radiating striæ; tubercles with much white hair; metathorax on each side with a very conspicuous stiff fringe of white hair; tegulæ shining rufous; wings dilute brownish, stigma dark brown, nervures paler; basal nervure falling a little short of nervulus; second cubital cell extremely long, the first recurrent nervure ending as far from its base as about 1·25 times first intercubitus, second recurrent very near its apex; legs black basally, knees, tibiæ and tarsi bright chestnut red, hind basitarsi blackened, the hair on their inner side shining creamy-white; hind spur with three long sharply pointed (aculeate) branches, and the apex long and very sharply pointed.

Hab.—Kojarena, W. Australia, Sept. 6, 1926 (A. J. Nicholson). A very pretty little species, closely allied to *E. simillima* (Smith), but known by the red tibiæ.

Euryglossidia mastersi *sp. nov.*

♀. Length 9 mm.; head and thorax black, abdomen chestnut red, with a purple lustre; mandibles reddened apically; flagellum obscure reddish beneath; tegulæ rufotestaceous; wings reddish-hyaline, stigma dusky rufous, nervures paler; anterior femora apically, and their tibiæ entirely, ferruginous, legs otherwise dark with pale hair; tarsi red at tip; hair at apex of abdomen dark fuscous; a distinct caudal plate. This is so much like *E. purpurascens* Ckll. that I was about to consider it identical, but the following differences are decisive: clypeus convex, not flattened on disc; scutellum more closely punctured, with no median depression; anterior tibiæ red; stigma shorter, being more obtuse apically; nervures much paler; first recurrent nervure reaching second cubital cell at a distance from base equal to about two-thirds first intercubitus; outer intercubitus regularly curved.

Hab.—King George's Sound (Geo. Masters).

EURYGLOSSIDIA VIRIDESCENS *sp. nov.*

♀. Length about or nearly 6·5 mm.; head and thorax black, the extremely large dullish area of metathorax slightly greenish; abdomen ferruginous, rather dusky or fairly bright, with the fourth segment and beyond dark olive green, the red segments with a transverse dusky subapical band, that on the second conspicuously undulate; extreme sides of second tergite with a large oval black spot; mandibles, labrum and clypeus black; flagellum clear red beneath except at base; tegulæ rufotestaceous; wings clear; stigma large, dusky red, nervures fuscous; legs mainly black, with white hair (tibial scopa white), anterior and middle knees red; tibiæ more or less reddish at base and apex; tarsi brown. Face very broad, with thin white hair; clypeus moderately shining, with conspicuous punctures; supraclypeal area elevated, shining, faintly greenish; front and vertex dull; mesothorax slightly shining, the punctures very minute, not clear under a lens; scutellum conspicuously shining; basal nervure meeting nervulus; second cubital cell long and produced apically, as usual in genus; first recurrent nervure received about as far from base as three-fourths first intercubitus; second recurrent meeting or almost meeting outer intercubitus; abdomen with the red parts dull, the others shining; apical tuft brown; venter reddened, with white hair.

Hab.—Geraldton, W. Australia, Sept. 4, 1928. 3 ♀ (A. J. Nicholson). Distinct by the coloration of abdomen and the venation.

EURYGLOSSIDIA NIGRESCENS *sp. nov.*

♂ (type). Length nearly 6 mm.; very slender, with narrow abdomen and extremely long antennæ; head and thorax black with thin long white hair, abundant on face (but not concealing surface), cheeks and occiput; mandibles black with tip red; malar space obsolete; facial quadrangle longer than broad, eyes distinctly converging below; clypeus shining, with large irregular punctures; front and vertex dull; scape rather short, shining black; flagellum very long, ferruginous beneath, dusky (but not black) above; mesothorax small and dull; scutellum and postscutellum microscopically sculptured all over the suture between them with a series of shining foveæ; area of metathorax very large, sharply defined, with an extremely fine microscopic reticulation; tegulæ reddish; wings clear hyaline, beautifully iridescent, stigma rufous with a dark margin, nervures fuscous; basal nervure nearly meeting nervulus; second cubital cell long, receiving first recurrent nervure at a distance from base equal to about half first intercubitus; second recurrent received almost at end; legs black, with knees, anterior tibiæ (dusky behind), middle and hind tibiæ at base and apex, and tarsi, ferruginous; abdomen very dark brown, in some lights faintly greenish, the hind margins of tergites 2 to 4 more or less pallid; venter with thin glittering white hair.

♀ more robust and a little longer; face broad, with the white hair at sides conspicuous; supra clypeal area shining, slightly greenish, with widely scattered punctures: antennæ short as usual in this sex, the slightly clavate flagellum clear ferruginous beneath except at end; legs darker, but anterior tibiæ entirely pale red in front; abdomen robust, with a dullish surface, very obscurely greenish; apex with dark fuscous hair; apical plate broad, narrowly truncate.

Hab.—Geraldton (type locality), W. Australia, Sept. 4, 1926, 2 ♂, 1 ♀ (A. J. Nicholson); Eradu, W. Australia, Sept. 8, 1926, 2 ♂ (A. J. Nicholson). Very distinct by the size and colour. There is a striking resemblance between the genus *Euryglossidia* and the South African genus *Strandiella* Friese. I believe there is some real affinity.

EURYGLOSSIDIA ERADUENSIS *sp. nov.*

♀. Length about 9 mm. (but abdomen is extended in type), long and narrow; dark green, the clypeus black, and the entirely dull mesothorax almost black; hair of head and thorax thin and white; face very broad, facial quadrangle broader than long; mandibles black, a little reddish apically; malar space obsolete; clypeus shining, but strongly and rather closely punctured, the punctures tending to be in rows; supraclypeal area polished, impunctate; antennæ rather long and slender, scape very long, curved, flagellum slender, very obscurely reddish beneath apically; front and mesothorax dull; scutellum dull, extremely closely and finely punctured, the punctures just visible under a lens; area of metathorax semilunar, dull, microscopically reticulate, and at sides with fine plicæ; tegulæ dark rufous; wings reddish hyaline; stigma dusky red, very obtuse at end; nervures fuscous; basal nervure nearly meeting nervulus; second cubital cell very long, longer below than first, receiving first recurrent nervure at a distance from base greater than length of first intercubitus, and second recurrent very near apex; legs black, with pale hair, tarsi reddened at tips; spur of anterior tibia peculiar, with a broad lateral translucent plate, and beyond that four sharp lateral spines; abdomen dullish, with micro scopical transverse lineolate-reticulate sculpture; apex with fuscous hair; apical plate large.

Hab.—Eradu, W. Australia, Sept. 8, 1926 (A. J. Nicholson). Easily known by the size, colour and venation. A key to the species of *Euryglossidia* will appear later in my synopsis of Australian bees.

Genus GNATHOPROSOPIS *Perkins, subg.* SPHÆRHYLÆUS *nov.*

1912. *Gnathoprosopis* Perkins, Ann. Mag. Nat. Hist., (8), ix, p. 104.

Orthotype.—Prosopis euxantha (Ckll. 1910) = *Prosopis xanthopoda* Cockerell 1910, *nom. præocc.*

Large bees, with globose male scape and large processes at sides of third abdominal sternite, but mandibles elongate (not abbreviated as in *Gnathoprosopis*); basal area of metathorax strongly rugose, hardly defined; stigma small; first recurrent nervure ending at base of second cubital cell; first abdominal segment very large; end of abdomen retracted, hairy. Type the following:

GNATHOPROSOPSIS (SPHÆRHYLÆUS) GLOBULIFERA *sp. nov.*

♂. Length 12 mm.; black, very robust, the thorax and abdomen above with thin short brown hair, but vertex, and abdominal segments beyond the third, with erect rather coarse black hair; apical part of abdomen slightly purplish; mandibles rather long and slender, black, bidentate; malar space almost obsolete; clypeus black, narrow, obtusely ridged in middle; sides of face (except lower end) up to level of middle ocellus, and front right across, bright chrome yellow; scapes developed into a pair of enormous yellow globular structures, which between them occupy the whole width of the face, and posteriorly fit into reddish depressions in the front; flagellum short, dark above, bright ferruginous beneath; mesothorax and scutellum dull, excessively minutely and closely punctured; the only yellow on thorax is on the tubercles, narrow upper border of prothorax (interrupted) and a small spot on the dark brown tegulæ; area of metathorax rugose; wings hyaline, slightly dusky, stigma and nervures piceous, basal nervure falling just short of nervulus; legs very dark brown, anterior tibiæ bright ferruginous in front; abdomen strongly punctured, moderately shining; third ventral segment on each side with a very large lamina, rounded anteriorly and produced into a stout spine posteriorly.

Hab.—King George's Sound (K.48307). One of the most remarkable bees yet discovered.

GNATHOPROSOPIS AMICULINA *Cockerell.*

1916. *Gnathoprosopis amicula* Ckll., Mem. Q'land Mus., v, p. 198. ♂, nec Smith, 1879.

1922. *Gnathoprosopis amiculina* Ckll., Mem. Q'land Mus., vii, iv, p. 265. ♀, ♂, Brisbane, Q.

Hab.—Burrenjuck, Feb., 1911. ♂.

GNATHOPROSOPIS AMICULA (*Smith*).

1879. *Prosopis amicula* Smith, Descr. New Sp. Hym., B.M., p. 19. ♀, Champion Bay.

Hab.—One Tree Hill, Brisbane, Q., Dec. 12, 1925, 2 ♀, 1 ♂ (A. Musgrave); Sydney, Sept., Oct., 2 ♂. This species was described from the female. In 1916 I described what I considered

to be the male, but it proved later to be a distinct species (*G. amiculina* Ckll.). I now have the real male before me, agreeing with the female in size, general appearance, sculpture of thorax and venation. It has the face shining as in *G. amiculiformis* (Ckll.), and is in fact very like that species, but the tibiæ are entirely bright orange-yellow; the hind femora are black with the apex yellow, the other femora are all yellow except at base; mandibles yellow; third abdominal sternite with a pair of small protuberances.

Genus MEROGLOSSA *Smith.*

1853. *Meroglossa* Smith, Cat. Hymen., B.M., i, p. 33, n. 11.

MEROGLOSSA DESPONSA (*Smith*).

1853. *Prosopis desponsa* Smith, Cat. Hymen., B.M., i. p. 31, n. 48. ♀, Australia.

Hab.—Sydney, ♀ (C. Gibbons).

MEROGLOSSA KELVINI (*Cockerell*).

1912. *Prosopis Kelvini* Cockerell, Ann. Mag. Nat. Hist., (8) x, p. 489. ♀, Brisbane, Q.

Hab.—Hornsby, March 5, 1919, ♂ (C. Gibbons). The specimen is peculiar for having the yellow on prothorax narrower, and well separated from that of tubercles, and the abdomen very obscurely reddish. This species has been placed in *Prosopis* or *Hylæus*, but it must be transferred to *Meroglossa*.

Genus PALÆORHIZA *Perkins.*

1908. *Palæorhiza* Perkins, Proc. Hawaiian Ent. Soc., ii, p. 29.

PALÆORHIZA (HETERORHIZA) HEDLEYI *sp. nov.*

♂. Length about 9 mm., anterior wing 7·7 mm.; black, rather robust, with light (not bright) yellow markings; face long and narrow, malar space large; mandibles black, labrum with a small yellow spot; clypeus very long, yellow with a narrow median keel, on each side of which is a grove; lateral edges of clypeus very narrowly black, and at each side of lower half this black is broadened into a shining depression; lateral face marks long and narrow, extending to top of eyes, abruptly narrowing at sides and front; a yellow stripe from ocelli to clypeus broadened at lower end; posterior orbits bordered by yellow; scape yellow in front, reddened behind; especially at base; flagellum dark, obscurely reddish beneath; mesothorax and scutellum closely punctured, the mesothorax dull; area of metathorax large, with strong longitudinal and radiating fluting; pleura finely and closely punctured, but shining;

sides of metathorax dull and excessively closely and minutely rugosopunctate; yellow markings of thorax including upper margin of prothorax, tubercles, four stripes on mesothorax, the lateral ones marginal, stripes covering axillæ and sides of scutellum, postscutellum except a quadrate black space in middle, two spots on area of metathorax, vertical bar below tubercles, transverse bar (narrowly broken) just below wings and another on lower part of mesopleura; tegulæ dark reddish, with a yellow spot; wings brown, quite dark, stigma and nervures dark; basal nervure meeting nervulus a little on outer side; second cubital cell moderately narrower above, receiving the recurrent nervures some distance from base and apex; anterior and middle trochanters and femora light red in front, the femora with a pale yellow apical spot; hind trochanters and femora black (except apical yellow spot of latter), the trochanters swollen; on the inner side the anterior femora are yellow from base to apex; anterior tibiæ yellow with a black stripe behind, but their tarsi dark; middle tibiæ reddish in front, black behind, pale yellow at base, the tarsi dark; hind tibiæ black with a yellow basal spot, their tarsi with red hair on inner side abdomen shining, finely and weakly punctured, the segments beyond the second with a fine pruinose pubescence; first segment with a large V-shaped yellow mark on each side, second with a transverse bar on each side, third with smaller marks, and fourth with still smaller; apex appearing broadly truncate, with a small spine at each corner. One specimen has the markings red, but this is due to cyanide.

Hab.—Murray Island, Torres Straits, 1907 (Chas. Hedley and A. R. McCulloch, K.28377). Three males, and another from the same source in the Queensland Museum. This belongs to the subgenus *Heterorhiza* Ckll., easily known by the fluted area of metathorax. The other species of this group are *P. melanura* (Ckll.), *P. denticauda* (Ckll.), and *P. longiceps* (Friese). The absence of red on the abdomen, with the presence of the V-like marks easily distinguish *P. hedleyi*.

Genus HYLÆUS *Fabricius*.

1793. *Hylæus* Fabricius, Ent. Syst., ii, p. 302.

HYLÆUS MUSGRAVEI *sp. nov.*

♂. Length about 10·5 mm.; robust, head and thorax black, the head very faintly metallic; abdomen deep rich purple shaded with green, very finely punctured; mandibles black, ordinary; face narrow, the very high clypeus (except lower edge), and broad lateral face marks bright orange, the lateral marks ending in a broad somewhat oblique truncation just above level of antennæ; supraclypeal area black; front and vertex entirely dull, cheeks with thin white hair; antennæ moderately long, entirely black, scape thick, but not

remarkable; mesothorax dull, rugulose, scutellum more shining; scutellum with a large triangular orange spot in middle, postscutellum with a smaller spot; tubercles large and flattened, orange; upper border of prothorax with a pair of orange lines; extreme base of metathorax with strong plicæ, the depressions between them shining, the lower part of the triangular area dull, without evident sculpture; tegulæ very dark brown; wings hyaline, faintly dusky; first recurrent nervure meeting intercubitus; legs black, anterior tibiæ light in front; apex of abdomen bidentate, the two structures very close together, obtuse apically; ventral segments 2 to 4 with white hair-bands.

Hab.—King George's Sound (K.37253). A very distinct species, running in my (MS.) key to *P. xanthaspis* Ckll., but much larger with scutellum and postscutellum only spotted. Named after Mr. A. Musgrave, who has made many contributions to Australian entomology.

HYLÆUS HONESTUS (*Smith*).

1879. *Prosopis honesta* Smith, Descr. New Sp. Hym. B.M., p. 19, n. 7. ♂, Tasmania.

Hab.—Tasmania, ♂. The wings are somewhat dusky.

HYLÆUS MOROSUS (*Smith*).

1879. *Prosopis morosa* Smith, Descr. New Sp. Hym. B.M., p. 26, n. 27. ♀, Australia.

Hab.—Hornsby, March, 1909, ♀ (C. Gibbons).

HYLÆUS METALLICUS (*Smith*).

1862. *Prosopis metallicus* Smith, Trans. Ent. Soc. Lond. (iii), i, 2, p. 59. ♀, ♂, Australia.

Hab.—Berowra, near Hawkesbury River, N.S.W., Dec. 11, 1923, ♂. One has the abdomen more conspicuously metallic than the other, but they are otherwise identical. They are 8·5–9 mm. long, which seems rather large, but they agree with Smith's description (of the supposed ♀, which is a male) and my notes of Smith's type.

HYLÆUS PERPLEXUS (*Smith*).

1853. *Prosopis confusa* Smith, Cat. Hymen. B.M., i, p. 30. ♀ (not Nylander).

1854. *Prosopis perplexa* Smith, Cat. Hymen. B.M., ii, p. 421, nom. nov. New Holland.

Hab.—French's Forest, N. Sydney, Nov. 7, 1922, ♀ (A. Musgrave).

This is certainly very near to *H. metallicus* Smith.

Hylæus amatiformis *sp. nov.*

♀. Length about 9·5 mm.; black, with broad cuneiform lateral face marks, tubercles, scutellum and postscutellum very bright deep orange; abdomen dark obscure green, the hind margins of the segments black. The upper border of prothorax has minute hardly noticeable yellow dots, almost exactly like the Queensland *H. amatus*, but certainly distinctly the following characters; larger (*H. amatus* less than 9 mm.); upper part of clypeus dullish, smooth, not striate; lateral face marks broader; abdomen obscure green instead of steel blue. It is also near *H. perplexus* Sm.

Hab.—King George's Sound (K.37234).

Hylæus gracilicaudis *sp. nov.*

♀. Length about 9 mm.; black, rather slender, the abdomen quite narrowly tapering at end; pubescence almost lacking, but long dark hairs on apical part of abdomen; apical half of middle tibiæ, and their basitarsi, posteriorly with a conspicuous band of shining white hair; hind femora apically behind with such a band, and the same on posterior edge of apical half of hind tibiæ; head ordinary, black, with broad orange lateral marks, filling space between clypeus and eye, and truncate (slightly emarginate) a short distance above level of antennæ; clypeus high, with large not very dense punctures; flagellum ferruginous beneath; mesothorax dull, with scattered very weak punctures (under the microscope they appear strong, on a very minutely tesselate surface); the following parts are bright orange; thickened and elevated upper border of prothorax (not joining tubercles), tubercles, scutellum, and large triangular spot on postscutellum; basal area of metathorax extremely short, not distinctly defined or sculptured (the microscope shows very small shining basal pits); posterior truncation entirely dull; tegulæ dark rufous; wings clear hyaline, stigma and nervures dark reddish; basal nervure falling a little short of nervulus; first recurrent nervure ending near apex of the extremely long first cubital cell; legs black, anterior tibiæ red in front; abdomen shining with small scattered punctures (the microscope shows two sizes, those visible under a lens, and excessively minute ones); venter normal, except that first sternite is swollen in the middle.

Hab.—King George's Sound (K.48293). Nearest to *H. daveyi* Ckll., from Victoria, but known by the rufous tegulæ, orange of post-scutellum reduced venation, and other characters.

Hylæus tasmani (*Cockerell*).

1929. *Hylæus simillimus tasmani* Ckll., Mem. Queensland Mus., ix, 3, p. 313. ♀, Tasmania.

Hab.—Tasmania, ♀. I described this as a race of *H. simillimus* Smith, but it is probably a distinct species, as the area of meta-

thorax is not rugose, but large and somewhat shining; the microscope shows excessively fine lines and reticulations. Also, the lateral face marks do not end on the orbital margin above, but are distinctly separated from it. The type locality of *H. simillimus* is Moreton Bay. The type of *H. tasmani* had the yellow on postscutellum reduced to a transverse median mark, but in the new specimen this yellow area is much larger, leaving only the sides black. It is a large, robust insect, with very stout abdomen, which is closely punctured.

Hylæus gibbonsi *sp. nov.*

♀. Length about 9 mm.; rather robust, black, with very little pubescence, but conspicuous white hair at sides of thorax posteriorly, a patch of bright white hair on inner face of middle tibiæ near apex, and white hair on inner face of posterior tarsi, conspicuous as a bright white line from behind; light markings chrome yellow (on thorax reddened by cyanide in type), consisting of lateral face marks, carrot-shaped in outline, rounded above at level of antennæ, pointed below, reaching about half way down sides of the very long clypeus; on thorax only the thickened collar and the tubercles are yellow, the yellow of collar narrowly but evidently separated from that of tubercles; tegulæ very dark brown; wings hyaline, with dark stigma and nervures, basal nervure falling short of nervulus, recurrent nervures joining second cubital cell about equally distant from its base and apex; legs black; abdomen pure black. Head elongated, with large malar space, clypeus not punctured (as seen under the lens), but with a median longitudinal raised line; under the microscope the clypeus and supraclypeal area are seen to have a remarkable structure of dense longitudinal striæ, and the clypeus also widely spaced minute punctures; flagellum clear ferruginous beneath except basally; mesothorax dullish, very minutely and densely punctured; scutellum very finely and closely punctured, but more shining; area of metathorax rugose; abdomen finely and closely punctured, the microscope shows the first two tergites with the surface minutely transversely lineolate, and the punctures much smaller and less closely placed than on the mesothorax and scutellum. Mandibles long enough to reach well beyond middle of clypeus. Abdominal venter not modified.

Hab.—Sydney, N.S.W. (C. Gibbons) (K.49012). Runs in my table next to the much smaller *H. amiculiformis* Ckll.

Hylæus nubilosus subnubilosus (*Cockerell*, 1910).

Hab.—Sydney, N.S.W., 2 ♂ (C. Gibbons). Meade-Waldo placed this species in *Palæorhiza*. It is not a typical member of *Hylæus* or *Palæorhiza*.

HYLÆUS CHRYSOGNATHUS (*Cockerell*).

1910. ***Prosopis chrysognatha*** Ckll. Journ. New York Ent. Soc., xviii, p. 102. ♀, ♂.

Hab.—Hornsby, ♂ (C. Gibbons).

HYLÆUS FREDERICI (*Cockerell*).

1853. ***Prosopis similis*** Smith, Cat. Hymen. B.M., i, p. 26 (nec. Fab. 1793).

1905. ***Prosopis frederici*** Ckll. Ann. Mag. Nat. Hist., (7) xvi, p. 403, nom. nov.

Hab.—King George's Sound, ♀. The specimen is peculiar for having a small broken yellow line on upper border of prothorax.

HYLÆUS INDECISUS *sp. nov.*

♀. Length about 6·3 mm.; head and thorax black, abdomen dusky red; mandibles dark red except at base and tip; labrum dark red; clypeus entirely black, dull, finely longitudinally striate and minutely punctured; lateral face marks represented by short yellow lines close to orbits opposite antennæ, but no other face marks: antennæ clear ferruginous, the scape slightly dusky in middle; no light marks on thorax except a pair of short cream coloured stripes on upper border of prothorax; mesothorax dull; scutellum dull, more or less shining at each side; tegulæ very dark reddish; wings hyaline, stigma and nervures light rufotestaceous; second cubital cell long, receiving first recurrent nervure near base; femora black except knees; anterior tibiæ pale yellowish red in front; middle and hind tibiæ dark, slightly pale at base and apex, the hind ones yellowish-white at base; tarsi clear ferruginous; abdomen red, variably dusky, not banded, its form robust and pyriform.

Hab.—Sydney, N.S.W., 2 ♀ (C. Gibbons). This species caused me some perplexity, because it so greatly resembles *Euryglossa semicastanea* Ckll., that I had placed it among the *Euryglossa*. However, it has no appreciable malar space, and does have a small and narrow but quite distinct pygidial plate, whereas *E. semicastanea* has a short but evident malar space, and no pygidial plate; nevertheless, the resemblance is astonishing. The stigma is exactly alike in the two bees, and while the second cubital cell is considerably longer in the type of *H. indecisus* than in the *Euryglossa*, the cotype has it as in the latter. It is difficult to believe that these bees are not closely related.

Genus HYLEOIDES *Smith.*

1853. ***Hyleoides*** Smith, Cat. Hymen. B.M., i, p. 32, n. 10.

HYLEOIDES CONCINNA (*Fabricius*).

1775. *Vespa concinna* Fabricius, Syst. Entom., p. 367, n. 21. New Holland.

Hab.—Cheltenham, Dec. 13, and National Park, Dec. 20, both N.S.W. (C. Gibbons). First collected by Banks on Captain Cook's first expedition and described by Fabricius as a wasp, which it much resembles.

HYLEOIDES ZONALIS *Smith.*

1853. *Hyleoides zonalis* Smith, Cat. Hymen. B.M., i, p. 33, n. 2. ♀, Australia.

Hab.—Two from Gayndah, Queensland. Smith says the tubercles are yellow, but they are black, with a large quadrate orange patch immediately behind them.

Family ANDRENIDÆ.

Genus NOMIA *Latreille.*

1805. *Nomia* Latreille, Hist. Nat. Crust. et Ins., xiii, p. 369, n. 411.

NOMIA FROGGATTI *Cockerell.*

1911. *Nomia froggatti* Ckll., Proc. Linn. Soc. N.S.W., xxxvi, p. 165. ♀, Solomon Islands.

Hab.—Lavoro Plantation, Guadalcanal I., Solomon Is., Sept., 1927, 1 ♂, 1 ♀ (C. E. Hart).

NOMIA PULCHRIBALTEATA *Cameron* 1901 *subsp.* PAPUANA *nov.*

♀. Length about 10 mm.; robust, black, the hind margins of abdominal tergites 1 to 4 with narrow pale tegumentary bands, more or less suffused with emerald green (the bands of *N. elliotí* Sm. are more than twice as broad); clypeus dull, with a median and lateral keels; supraclypeal area also keeled; hair of face and thoracic dorsum pale ochreous; of cheeks, pleura and sides of metathorax white; antennæ black, scape long; mesothorax and scutellum dull, closely punctured; scutellum obtusely bigibbous, but not tuberculate; postscutellum with a pair of stout pointed teeth; area of metathorax very short, transversely ridged laterally; tegulæ black with pallid margin; wings greyish hyaline, not at all reddish, with a vague dusky apical cloud; second cubital cell receiving recurrent nervure at or a little beyond middle; legs black with pale hair, light reddish on inner side of hind tarsi; abdomen well but shallowly punctured; apex with fuscous hair.

Hab.—Kokodato, Isurava, British New Guinea, June 14, 1921 (E. O. Pockley).

Typical *N. pulchribalteata* Cameron comes from New Britain, and has strongly reddish wings. I possess only the male, but on comparison feel sure that the New Guinea insect is at least a subspecies. In *N. pulchribalteata* the teeth on postscutellum are more slender, and divergent, the area of metathorax has cross-ridges in middle at base (the surface at this point in *papuana* dull, without any ridges), and the scutellum is bituberculate. It is thus not improbable that the discovery of the male will show *papuana* to be a distinct species.

NOMIA KURANDINA *Cockerell* 1910 *subsp.* FORTIOR *nov.*

♂. Larger, fully 10 mm. long; antennæ and tegulæ entirely black; clypeus practically all pallid brownish; mesothorax shining between the punctures; inner apical lobe of hind tibiæ broadly yellowish ferruginous; seen from above the abdomen appears constricted between the first and second segments, and in the constriction is dense white hair; broad band of white hair on third segment not overlapped by long pale hairs; apex with coarse black hair. The dark apical spots on anterior wings are large and very conspicuous.

Hab.—Gundamaian, Port Hacking, N.S.W., Jan. 30-31, 1925 (T. G. Campbell). In the closed apical lobe of hind tibia, but not otherwise, this resembles the form from Mackay, which Friese called *N. macularis.*

NOMIA FERRICAUDA *Ckll.* 1913 *subsp.* MUSGRAVEI *nov.*

♀. Third abdominal segment all black, with the broad band of appressed hair greyish white; fourth segment black at base, and more broadly at sides, the abdomen beyond this red; area of metathorax not so large, and not so distinctly and regularly cross-ribbed.

Hab.—Como near Sydney, N.S.W., Nov. 7, 1923 (A. Musgrave and T. G. Campbell).

NOMIA FLAVOVIRIDIS *Ckll.* 1905 *subsp.* EXCELLENS *nov.*

♂. Larger or at least more robust; hind femora considerably stouter, hind tibiæ very broad and thick; femora apically, and hind ones in greater part, ferruginous; tibiæ and tarsi red, with pure white hair. Head and thorax hardly metallic but the pleura conspicuously green; abdomen obscurely green, dull and extremely densely punctured, the hair bands white, on a brassy surface; flagellum very dark brown above, ferruginous beneath; tegulæ extremely bright apricot colour; stigma and nervures dusky reddish; two very conspicuous spots of white pubescence in front of scutellum.

Hab.—Sydney, N.S.W. (C. Gibbons). Perhaps a distinct species. We now know eight forms of this group of *Nomia*, and it

is difficult to say whether all should be treated as races of one (in which case *N. ænea* Smith, from Port Essington, would be the name of the species), or as a series of closely related species.

NOMIA MŒRENS *Smith* 1875, *subsp.* ULONGENSIS *nov.*

♂. Length 10·5 mm.; entirely black, except that the anterior tibiæ are dusky red in front, the other tibiæ variably red at base and apex, the hind tibiæ obscure or rather clear red or brown, with a dusky area on outer side, the tarsi are dull reddish, and the tegulæ deep chestnut red. The male of *N. mœrens* Smith has not been described, but this insect differs from it structurally only in the usual sexual characters, and I should refer it to typical *N. mœrens,* but for the conspicuous red tegulæ. The area of metathorax with fine cross ridges, is exactly the same. The following characters of the male should be noted; mandibles and clypeus entirely black, the latter coarsely punctured; antennæ long, entirely black; hind femora swollen, shining, not appreciably curved; hind tibiæ stout, trigonal, the anterior edge bulging, but no apical lobe; abdomen parallel-sided, finely and closely punctured, tergites 2 to 5 with narrow white hair bands, not very conspicuous, otherwise they are beset with erect black hair; venter flat. The wings are dusky hyaline, the outer margin a little darker, especially the apex. Stigma small and dusky red, as in *N. mœrens.*

Hab.—Ulong, East Dorrigo, N.S.W., Feb. April, 1923, 6 ♂ (W. Heron).

NOMIA AURANTIFER SWAINSONIÆ *Cockerell.*

1921. *Nomia aurantifer swainsoniæ* Ckll., Mem. Queensland Mus., vii, 3, p. 82. ♂, ♀, National Park, Queensland.

Hab.—Two of each sex; Sydney (C. Gibbons). In Hacker's Catalogue (Hacker, Mem. Queensland Mus., vii, 3, 1921, p. 132), *N. lutesfaciata* Friese is placed under this form; it belongs to *N. aurantifer* proper.

Genus HALICTUS *Latreille.*

1804. *Halictus* Latreille, Nouv. Dict. H.N., xxiv (tab.), p. 182.

1805. *Halictus* Latreille, Hist. Nat. Crust. et Ins., xiii, p. 364, n. 409.

HALICTUS PERAUSTRALIS *Cockerell.*

1904. *Halictus peraustralis* Cockerell, Ann. Mag. Nat. Hist., (7) xiv, p. 211. ♀, S. Australia.

Hab.—National Park, N.S.W., Dec. 23, 1906, ♀. (C. Gibbons). This resembles a small Eumenid wasp.

Halictus blandulus *sp. nov.*

♀. Length nearly 6 mm., broad and robust; head and thorax black, thinly but conspicuously hairy, the hair greyish white, very faintly yellowish dorsally; mandibles reddened apically; flagellum obscurely reddish beneath; tegulæ rufotestaceous; wings hyaline, strongly iridescent, stigma dull testaceous; outer recurrent and intercubitus obsolescent; legs dark rufous, with much dark reddish brown except the broad apical margin, apex with very pale, slightly yellowish hair. Head ordinary, face broad, but orbits converging below; clypeus and supra clypeal area shining, with sparse distinct punctures; front dull, but a crescentic shining space in front of middle ocellus; mesothorax and scutellum shining, but distinctly and quite closely punctured; scutellum with a median sulcus; area of metathorax large, dull, with a fine uniform granular sculpture (under microscope fine irregular rugæ, the spaces between them very delicately reticulate or lineolate); hind spur of hind tibia with two distinct obtuse teeth, and others minute and rudimentary.

Hab.—King George's Sound, W.A. Resembles *H. clarigaster* Ckll., but abdomen much broader and duller, and flagellum not distinctly red beneath. Easily known from *H. ewarti* Ckll. by the dull abdomen, colour of legs and sculpture of thorax.

Halictus lavoroensis *sp. nov.*

♀. Length about 7 mm., but anterior wings short, hardly 5 mm.; head and thorax shining yellowish green or golden green, the mesothorax, especially posteriorly, with strong coppery tints, the vertex bluish green, not brilliant, the scutellum highly polished, almost impunctate; tegulæ very dark reddish; wings hyaline, with large black stigma; first recurrent nervure meeting second inter cubitus; outer intercubitus and recurrent obsolescent; trochanters black; femora black, red at apex, and middle and hind ones more or less red at base; tibiæ and tarsi clear bright ferruginous; abdomen dark olive green, highly polished, without bands, the caudal rima red; venter with a scopa of long curled hairs. Head broad; face very broad; mandibles red; face with a slight coppery suffusion; clypeus shining, with strong punctures; front with longitudinal striæ, not at all transverse in front of middle ocellus; antennæ black, a little reddened at apex; mesothorax with scattered fine punctures on a very delicately lineolate surface, and minute branched hairs; pleura finely striate (plicatulate); area of metathorax coarsely reticulate, the areas between the ridges shining.

Hab.—Lavoro Plantation, Guadalcanal I., Solomons, July-Sept., 1923, 2 ♀ (C. E. Hart).

Allied to *H. exterus* Ckll., but in front below ocelli without transverse striæ, femora broadly reddened at apex, mesothorax with coppery tints, and abdomen with a ventral scopa. I thought to name it after its discoverer but there is already an *H. hartii* Robertson.

HALICTUS CRETINICOLA *Friese.*

1909. *Halictus cretinicola* Friese, Ann. Mus. Nat. Hung., vii, p. 190. ♂, ♀, New Guinea.

Hab.—Mt. Lamington district, Northern Division, Papua, May, 1927, ♀ (C. T. McNamara). Exceedingly close to the Australian *H. urbanus* Smith, but the face is narrower, obscure green, the area of metathorax is shorter, and the first abdominal tergite has the hind margin shining brown.

HALICTUS BURSARIÆ *Cockerell.*

1916. *Halictus bursariæ* Cockerell, Mem. Queensland Mus., v, p. 203. Caloundra, Q. ♂.

Hab.—Mt. Tambourine, Queensland, Dec. 19, 1925, 6 ♂ (A. Musgrave and G. P. Whitley).

HALICTUS EBORACENSIS *Cockerell.*

1918. *Halictus eboracensis* Cockerell, Mem. Queensland Mus., vi, p. 117. ♂, Ebor, N.S.W.

Hab.—Barrington Tops, N.S.W., Jan. 20-24, 1927, 3 ♀ (T. G. Campbell).

HALICTUS BICINGULATUS *Smith.*

1853. *Halictus bicingulatus* Smith, Cat. Hym. B.M., i, p. 57. ♀.

Hab.—National Park, N.S.W., 1.12.1906, ♀ (C. Gibbons).

HALICTUS SEDUCTUS *Cockerell.*

1914. *Halictus seductus* Cockerell, Ann. Mag. Nat. Hist., (8), xiii, p. 512. ♀, Windsor, Victoria.

Hab.—Launceston, Tasmania, 7.11.1915, ♀ (F. M. Littler).

HALICTUS LANARIELLUS *Cockerell.*

1916. *Halictus lanariellus* Cockerell, Proc. Acad. Nat. Sci. Philad., p. 373. ♀, Yarrawin, N.S.W.

Hab.—Middle Harbour, N.S.W., Dec. 30, 1905, ♂ (C. Gibbons). This was described from the female. The male with the same sculpture, area of metathorax, etc., is a little over 7 mm. long, quite slender, without hair-bands on abdomen. The clypeus has a large white transverse apical spot; antennæ long, black, with the flagellum very faintly brownish beneath; mesothorax polished but with distinct punctures; stigma dull ferruginous; tegulæ rufopiceous; legs slender, entirely dark.

HALICTUS SEMINITENS *sp. nov.*

♀. Length about 7·3 mm.; fairly robust, black, including mandibles, antennæ and legs; tegulæ very dark reddish, almost black; wings greyish-hyaline, stigma and nervures dark fuscous; face very broad; clypeus short and convex, moderately shining, not at all sulcate, and with irregular punctures; supraclypeal area dull; hair of head and thorax thin and dull white; mesothorax in middle polished, with not very dense punctures, but the anterior corners are broadly quite dull (cross-striated under microscope), the dull patch triangular, with its acute posterior corner almost reaching scutellum, the dull sharply separated from the polished area; scutellum large and flattened, not at all sulcate, shining, very minutely punctured; tubercles pointed; white tomentum of post-scutellum only conspicuous when seen from the side; area of metathorax very large, without any shining rim, its surface very delicately and minutely lineolate, the middle portion more or less reticulate; mesopleura dullish, first recurrent nervure joining second cubital cell near end; outer recurrent and intercubitus weakened; legs with white hair; hind basitarsi with a conspicuous red apical tuft; abdomen moderately shining, very finely punctured, second segment at base with lateral white hair-patches, third and fourth with basal bands of white tomentum; venter with long glittering white hair, not forming a curled scopa.

Hab.—Wyalcatchem, W. Australia, Aug. 30, 1926, 2 ♀ (A. J. Nicholson). Very like *H. orbatus* Smith, *H. instabilis* Ckll., and *H. imitans* Ckll. but easily known by the contrasting polished and dull areas on mesothorax. The dark tegulæ are also distinctive.

Genus PARASPHECODES *Smith.*

1853. *Parasphecodes* Smith, Cat. Hym. B.M., i, p. 39.

PARASPHECODES TOOLOOMENSIS *Cockerell* 1929 *var.* MUSGRAVEI *var. nov.*

♀. Has the head, mesothorax and metathorax entirely black, while the scutellum and postscutellum are clear bright ferruginous. The prothorax is red, but the pleura black slightly suffused with red; antennæ black, with the flagellum obscurely reddish beneath, legs red; abdomen with the basal half dark reddish, the apical half black. Whether this represents an individual variation or a subspecies it is impossible to say at present.

Hab.—National Park, Macpherson Range, Queensland, Dec. 22, 1926 (A. Musgrave).

PARASPHECODES LICHATUS *Smith.*

1853. *Parasphecodes lichatus* Smith, Cat. Hym. B.M., i, p. 40. ♀, West Australia.

Hab.—Eradu, W. Australia, Sept. 8, 1926, 3 ♀ (A. J. Nicholson). Kojarena, W.A., Sept. 6, 1 ♀ (A. J. Nicholson).

Family MELETIDÆ.

Genus CROCISA *Jurine.*

1807. *Crocisa* Jurine, Litt. Leitg. (Erlangen) Intile. Blatt., p. 164.
1807. *Crocisa* Jurine, Nouv. Méth. Class. Hymenopt., p. 239.

CROCISA GEMMATA *Cockerell.*

1911. *Crocisa gemmata* Ckll., Proc. Linn. Soc. N.S.W., xxxvi, p. 166. ♀, ♂, Solomon Is.

Hab.—Lavoro Plantation, Guadalcanal I., Solomon Is., 1925 (C. E. Hart); Buoi (Bougainville), Buka Passage, Sept. 2, 1922 (E. O. Pockley); Suvai, Bougainville, Sept. 26, 1922 (E. O. Pockley).

CROCISA CÆRULEIFRONS *W. F. Kirby.*

1883. *Crocisa cæruleifrons* Kirby, Proc. Zool. Soc. Lond., p. 343. ♀, Maroe, Timor Laut.

Hab.—Two females collected by E. O. Pockley in British New Guinea. Koitaki, 5 12.5.1921; Sogeri to Port Moresby, July 26, 1921.

CROCISA QUARTINÆ *Gribodo.*

1884. *Crocisa quartinæ* Gribodo, Bull. Soc. Entom. Ital., xvi, p. 272. ♀, ♂, Mackay, Cooktown, Queensland.

Hab.—Two males collected by E. O. Pockley; Urikituru, British New Guinea, 22.6.1921. One has the abdominal markings rich violaceous blue; the other has them almost emerald colour, and has the anterior lateral spots of the mesothorax confluent with the anterior marginal band, which also is continuous with the median mark, the latter appearing merely as a backwardly directed process from the band. In both, the band on the second tergite is narrowly interrupted. This is a more robust insect than *C. cæruleifrons*, with the basal band of the abdomen not or hardly interrupted, and the posterior black incision in this band subtriangular, not produced laterally as in *C. cæruleifrons*. *C. quartinæ* was described from Celebes, but Friese (1909) cites several localities in New Guinea.

Species of *Crocisa* from Mt. Lamington district and Fly River, New Guinea, appear to have been in alcohol, and are quite unfit for study. Collectors should be warned not to put bees in any liquid.

Family ANTHOPHORIDÆ.

Genus ANTHOPHORA *Latreille.*

1804. *Anthophora* Latreille, Hist. Nat. Crust. Ins., xiv, p. 45.

ANTHOPHORA SAPIENS *Cockerell.*

1911. *Anthophora sapiens* Ckll., Proc. Linn. Soc. N.S.W., xxxvi, p. 167. ♀, Solomon Is.

Hab.—Lavoro Plantation, Guadalcanal I., Solomon Islands, Sept., 1927, 16 ♂ (C. E. Hart). This species was described from the females, though in the original publication the sign is printed upside down. The male has the scape broadly light in front; clypeus light with a broad black mark on each side coming to a sharp point a little more than half way down. The blade of the maxilla is fully 4·5 long, while in the female it is less than 4. The nearest relative is *A. aurata* Friese, from New Pomerania, but that has much darker hair on the thorax.

ANTHOPHORA VIGILANS *Smith.*

1860. *Anthophora vigilans* Smith, Proc. Linn. Soc., Zool., iv, p. 92, n. 1. ♀, Celebes.

Hab.—Four females from New Guinea; Mt. Lamington district, July, 1927 (C. T. McNamara), and Koitaki, May 5-12, 1921 (E. O. Pockley). This extends from Celebes and Amboina to New Guinea. The New Guinea specimens have the tegument of the legs very dark, and the abdominal bands vary from a warm light reddish brown to more or less pale green. Comparison with a good series from Celebes might indicate racial differences deserving recognition.

A. vigilans has been regarded as a variety of *A. zonata* L., although it looks very different. It is really very close to *A. cingulata* Fabr., which Friese wrongly calls *A. cincta* Fabr., the latter name really pertaining to an African species. A female from the Mt. Lamington district, New Guinea, July 23 24, 1927 (C. T. McNamara) has green bands, and is extremely like Australian *A. cingulata,* only the bands are rich emerald green, quite a different shade of colour. Although I am convinced that this is only a variety of *A. vigilans,* it is so distinct in appearance that it deserves a name, as follows:

ANTHOPHORA VIGILANS *var.* MCNAMARÆ *var. nov.*

♀. In general like *A. cingulata,* but abdominal bands broad and very bright emerald green glistening but not very shiny, more or less overlaid at base with golden hairs; eyes black or dark brown; hair on outer side of hind tibiæ bright ferruginous, with no apical white tuft. The hair of the thorax above is bright ferruginous; on pleura pallid, but not white. The clypeus has a pale reversed T, and the scape has a light mark in front, wings dusky.

ANTHOPHORA ZONATA (*Linne*).

1758. *Apis zonata* Linne, Syst. Nat. Ed., x, p. 576.

Hab.—Buna to Saputa, British New Guinea, June 5, 1921, ♀ (E. O. Pockley). This has white hair on outer side of hind tibiæ, and agrees with *A. zonata* which I have from Formosa.

Family MEGACHILIDÆ.

Genus Cœlioxys *Latreille.*

1809. ***Cœlioxys*** Latreille, Gen. Crust. et Ins., iv, p. 166.

Cœlioxys weinlandi *Schulz.*

1904. ***Cœlioxys weinlandi*** Schulz, Berlin Ent. Zeitschr., xlix, p. 235. New Guinea.

Hab.—Mt. Lamington, Papua, May, 1927, ♂ (C. T. McNamara).

Cœlioxys smithii *Dalla Torre.*

1860. ***Cœlioxys intrudens*** Smith, Proc. Zool. Soc. Lond., iv, Suppl., p. 132. ♀ (nec p. 92). Batchian.

1896. ***Cœlioxys smithii*** Dalla Torre, Cat. Hym., x, p. 493.

Hab.—Mt. Lamington, Papua, May, 1927, ♂ (C. T. McNamara); abdomen octodentate, as Friese has described.

Genus Lithurgus *Berthold.*

1825. "Lithurge" Latreille, Fam. Nat. Regne Anim., p. 463. Monotype *Centris cornuta* Fab. Vernacular only.

1827. ***Lithurgus*** Berthold, in Latreille, Nat. Fam. Thierr., p. 467. Monotype *Centris cornuta* Fabr.

1829. ***Lithurgus*** Latreille, in Cuvier, Le Regne Animal, 2nd Ed., v, p. 350.

Lithurgus scabrosus (*Smith*).

1858. ***Megachile scabrosa*** Smith, Journ. Linn. Soc. Lond., Zool., iii, p. 134, n. 2. ♀, Aru.

Hab.—Daru, Papua, Feb. 20, 1923, 2 ♀ (Cowley).

Lithurgus scabrosus froggatti (*Cockerell*).

1929. ***Lithurgus scabrosus*** Cockerell, Ann. Mag. Nat. Hist., x, (3) p. 197 (re synonomy).

Hab.—Malekula, New Hebrides, 2 ♀. These differ from the original specimen (from Epi) in the more evident, though excessively fine, abdominal bands. The wings are conspicuously dusky, and might be described as dilute fuliginous.

This was described as a variety of *L. albofimbriatus* Sichel. It agrees with *L. scabrosus* Smith from New Caledonia and Mindanao (Philippine Is.) in having the first recurrent nervure enter the extreme basal corner of the second cubital cell, whereas in *L. albo-*

fimbriatus from Tahiti and the Hawaiian Islands, it goes distinctly beyond the corner, leaving an appreciable interval. On this basis the form from Vavau, Tonga Is., is *L. scabrosus,* but it has quite dusky wings. One from Apia, Samoa, should be *L. albofimbriatus.*

Perkins and Cheesman (1928) treat *L. albofimbriatus* (described from Tahiti) as a synonym of *L. scabrosus* (Sm.), which originally came from the Aru Islands. It is, however, noteworthy that they describe a new *L. brachipes,* based on a male collected in Samoa in 1875. It is possible that there are several species in this group, which will be separated when the males have been studied; but as matters now stand, it is difficult to define more than one valid species.

LITHURGUS ATRATIFORMIS *Cockerell.*

1905. *Lithurgus atratiformis* Ckll., Ann. Mag. Nat. Hist., (7) xvi, p. 295. ♀.

Hab.—One ♂, Fly River, New Guinea (Geo. Soc. Exp.).

LITHURGUS RUBRICATUS *Smith.*

1853. *Lithurgus rubricatus* Smith, Cat. Hym. B.M., i, p. 146. ♀, Australia.

Hab.—Byfield, near Yeppoon, Q., Oct., 1924. A small female (A. Musgrave).

LITHURGUS FORTIS *sp. nov.*

♀. Length 13 to 17 mm.; black, robust, with entirely black ventral scopa; tongue extremely long; prominence on face large, tuberculate, with a transverse arched keel; clypeus rugose, apically with a beard of long dull red (a sort of purplish red) hair; front and sides of face above with red hair, vertex with thin black hair; antennæ short, black; cheeks with long red hair; mesothorax and scutellum bare, entirely dull, the mesothorax transversely rugose; sides of thorax with much long red hair, but a little dark hair behind the hind wings; area of metathorax shining, with a transverse concavity; tegulæ black; wings smoky, second cubital cell receiving first recurrent at extreme base; legs with black hair, long red hair on anterior trochanters; abdomen above shining, very minutely punctured, wholly without bands; hair at apex dense and black.

Hab.—Solomon Islands, 18 ♀. Type from Lavoro Plantation, Guadalcanal Island, Sept., 1927 (C. E. Hart, K.57715). Seven others come from the same place; five from Banoni, Bougainville, Oct. 20, 1922 (E. O. Pockley); five are simply marked Solomon Islands (C. M. Woodford). A very distinct species, easily known by the black ventral scopa, and red hair on thorax.

Genus MEGACHILE *Latreille.*

1802. *Megachile* Latreille, Hist. Nat. Fourmis, p. 434.

MEGACHILE NIDULATOR *Smith.*

1864. *Megachile nidulator* Smith, Journ. Linn. Soc. Zool., viii, p. 92, n. 4. ♀, N. Guinea.

Hab.—Mt. Lamington district, Northern Division, Papua, July, 1927, 1 ♀ (C. T. McNamara).

MEGACHILE PRETIOSA *Friese.*

1908. *Megachile albobasalis* Friese, Nova Guinea, v, Zool., tab. xv, f. 13. ♀, Queensland (*nec* Smith, 1879).

1909. *Megachile pretiosa* Friese, Ann. Mus. Nat. Hung., vii, p. 251. ♀, Cairns, Q.

Hab.—New Guinea: Mt. Lamington, May, 1927, 8 ♀ (C. T. McNamara); Mt. Lamington district, July, 1927, 3 ♀ (C. T. McNamara); Urikituru to Sogeri, June 22, 1920 (E. O. Pockley); Iorabiwa to Urikituru, June 21, 1921 (E. O. Pockley); Koitaki, May 5-12, 1921 (E. O. Pockley). The type of *M. pretiosa* was said to come from Cairns, Q.; I have not seen it from Australia.

MEGACHILE HERTLEI (*Friese*).

1914. *Xylocopa bryorum* var. *hertlei* Friese, Tijds. Ent., lvii, 61. ♀, Finschafen, New Guinea.

Hab.—New Guinea: Mt. Lamington, May, 1 ♀ (C. T. McNamara); Mt. Lamington district, July, 5 ♀ (C. T. McNamara);

MEGACHILE LACHESIS *Smith.*

1860. *Megachile lachesis* Smith, Journ. Proc. Linn. Soc. Zool., iv, Suppl., p. 133, n. 2. ♀, Batchian.

Hab.—Suvai, Bougainville, 27.9.1923 (E. O. Pockley); and the following from New Guinea: Mt. Lamington, May, 5 ♀, 1 ♂ (C. T. McNamara); Koitaki, May 5-12 (E. O. Pockley); Mabu Duan, April 6 (E. O. Pockley); Kevema, March 20 (E. O. Pockley); Urikituru to Sogeri, June 22 (E. O. Pockley).

MEGACHILE USTULATA *Smith.*

1862. *Megachile ustulata* Smith, Trans. Entom. Soc. Lond., (3) 1, 2, p. 61, n. 1. ♀, Australia.

Hab.—National Park, Macpherson Range, Q.; Dec. 18-24, 1926 (A. Musgrave). One is also labelled R. Illidge.

MEGACHILE MYSTACEA (*Fabricius*).

1775. *Apis mystacea* Fabricius, Syst. Entom., p. 385, n. 41. New Holland.

Hab.—Sydney, N. S. Wales (C. Gibbons); Rockhampton, Q. Oct., 1924 (A. Musgrave). This is another of the species discovered by Banks on Captain Cook's first expedition.

MEGACHILE HENRICI *Cockerell*.

1907. *Megachile henrici* Cockerell, The Entom., xl, p. 223. ♀.

Hab.—Sydney, N. S. Wales (C. Gibbons).

MEGACHILE INSULARIS *Smith*.

1858. *Megachile insularis* Smith, Journ. Proc. Linn. Soc. Zool., iii, p. 134, n. 3. ♀, Aru.

Hab.—Mt. Lamington, Papua, May, 1927, 1 ♀ (C. T. McNamara). The wings are darker than in the typical form from the Aru Islands. The Australian *M. pictiventris* Smith is closely allied.

MEGACHILE NIGROHIRTA *Friese*.

1909. *Megachile placida* Smith var. *nirgohirta* Friese, Ann. Mus. Nat. Hung., vii, p. 250. New Guinea; New Britain; Roon Is.

Hab.—Mt. Lamington district, Papua, July, 1927, 1 ♀ (C. T. McNamara). Described as a variety of *M. placida* Smith, but I believe a distinct species.

MEGACHILE ALBOMARGINATA *Smith*.

1879. *Megachile albomarginata* Smith, Descr. New Sp. Hymen., p. 66, n. 16. ♀, New Caledonia.

Hab.—New Caledonia, 1 ♀ (Dr. Maileret).

MEGACHILE AUSTRALIS *Lucas*.

1876. *Megachile australis* Lucas, Ann. Soc. Entom. France, (5) vi, p. 303. ♀, New Caledonia.

Hab.—New Caledonia, 3 ♀ (Dr. Maileret).

MEGACHILE BIROI *Friese*.

1909. *Megachile biroi* Friese, Ann. Mus. Nat. Hung., vii, p. 235 ♀, ♂, Milne Bay, New Guinea.

Hab.—Mt. Lamington, Papua, May, 1927, 4 ♂ (C. T. McNamara).

MEGACHILE HACKERI *Cockerell.*

1913. *Megachile hackeri* Cockerell, The Entomologist, xlvi, p. 166. ♂, ♀, Brisbane, Stradbroke Is., Queensland.

Hab.—Sydney, N.S.W., 2 ♀ (C. Gibbons).

MEGACHILE QUINQUELINEATA *Cockerell.*

1906. *Megachile quinquelineata* Cockerell, Ann. Mag. Nat. Hist., (7) xvii, p. 534. ♀, Queensland.

Hab.—Byfield, near Yeppoon, Q., Oct., 1924, ♀ (A. Musgrave).

MEGACHILE CETERA *Cockerell.*

1912. *Megachile cetera* Cockerell, Ann. Mag. Nat. Hist., (8) ix, p. 220. ♀, N. S. Wales and Victorian localities.

Hab.—Botanical Gardens, Sydney, Nov. 6, 1912, ♀ (A. Musgrave).

MEGACHILE RUFAPICATA *sp. nov.*

♀. Length about 9 mm.; black, of parallel-sided type; sixth abdominal tergite and sternite rather dark red, but fifth entirely black; ventral scopa entirely pure white. Head broad, with very conspicuous triangular lateral patches of dense pure white, the triangles with the broad base on the anterior orbits, the apex at the antenna; mandibles black, elongated, without distinct teeth; clypeus very broad, extremely densely punctured, the marginal region shining, the margin without teeth, except a feeble indication of a median denticle; supra clypeal area heavily punctured except on disc, whence it is smooth and polished; flagellum dull red beneath; front dull, very densely punctured; vertex and cheeks very broad, lower anterior part of cheeks shining; hair of head and thorax scanty, but long white hair on scutellum and metathorax; mesothorax dull, excessively densely punctured; scutellum shining, with large separate punctures; area of metathorax dull; tegulæ black; wings clear, with dark stigma and nervures; second cubital cell very long, receiving recurrent nervures about equally distant from base and apex; legs black, with pale hair, white on inner side of hind tarsi; abdomen well punctured, moderately shining, with weak pale bands, and a white patch at each side of first segment; second and third segments with a transverse median area which is polished and sparsely punctured.

Hab.—Almaden, North Queensland, April 25, 1928 (W. D. Campbell). In the tables this runs to *M. apicata* Smith, and is in fact closely allied, differing by the broader face (broadening rather than narrowing below), the shining scutellum with sparse large punctures, the apical segment of abdomen not black in middle, etc.

MEGACHILE OCULIPES *Cockerell.*

1910. *Megachile oculipes* Cockerell, Ann Mag. Nat. Hist., (8) vi, p. 363. ♂, Townsville, Queensland.

Hab.—King George's Sound, Western Australia, ♂.

MEGACHILE FULVOMARGINATA *Cockerell.*

1906. *Megachile fulvomarginata* Cockerell, Ann. Mag. Nat. Hist., (7) xvii, p. 531. ♀, Queensland.

Hab.—Almaden, Chillagoe district, North Queensland, April, 1927, ♀ (W. D. Campbell). Closely related to *M. relicta* Cockerell, but easily separated by the long mandibles, the edge fringed with fulvous hair, the orbits diverging below, etc.

MEGACHILE CARTERI *sp. nov.*

♀. Length 8·7 mm.; black, robust, but of parallel sided type; ventral scopa white with a faint creamy tint, short and black on last segment; sides of face, cheeks, tubercles and metathorax with conspicuous white hair; clypeus with short inconspicuous fuscous hair, appearing black in sharp contrast with the dense white hair in angles between clypeus and eyes; vertex, mesothorax, and scutellum with very inconspicuous short fuscous hair; face broad, eyes slightly converging below; eyes dark brown; mandibles very short and broad, rather obscurely quadridentate; clypeus dull, very densely and coarsely punctured, with no smooth median line; apical margin of clypeus shining, in middle with a very small shallow emargination, and a pencil of pale orange hair projecting below each side of the emargination; supraclypeal area shining, with strong irregular punctures; front entirely dull; antennæ entirely black; vertex with large distinct punctures; mesothorax and scutellum dull and very closely punctured, the scutellum excessively closely and finely; area of metathorax dull; tegulæ black; wings dilute brownish, stigma and nervures black; second cubital cell very long, receiving first recurrent nervure further from base than second from apex; legs black with pale hair, dense and white on outer side of mid tarsi; red on inner side of hind tarsi; hind basitarsi somewhat broadened, but not nearly as broad as the tibiæ; abdomen finely punctured, first segment with a patch of white hair at each side, segments 2 to 5 with very narrow (not broadened laterally) pure white hair-bands, failing in middle on second; sixth segment abruptly descending, not conspicuously hairy. Hind basitarsi fringed posteriorly with chocolate coloured hair.

Hab.—Kuranda, North Queensland (H. J. Carter).

Near to *M. simplex* Smith, differing by lack of white hair on clypeus and of pale pruinose pubescence covering apex of abdomen;

and the bands of the abdomen are narrower at sides. There is no black hair at sides of scopa. Named after the eminent coleopterist who collected it.

MEGACHILE PAPUANA *sp. nov.*

♀. Length about 11 mm.; black with elongate-cordiform abdomen; ventral scopa white with a faint creamy tint, black on last segment, and at extreme sides of others; mandibles entirely black; flagellum ferruginous beneath; face and front with much long pale yellow hair, vertex with black hair, but edge of occiput with a little yellow; cheeks and pleura with long white hair; thorax above with thin dark hair, conspicuous on scutellum, but the margins of the mesothorax with pale yellow hair, and two pale yellow marks on mesothorax anteriorly; tegulæ black; wings dusky; legs black, with pale hair; hair on inner side of middle tarsi brilliant orange red, but on inner side of hind tarsi darker red, but appearing brown in some lights; abdomen with narrow slightly yellowish bands; last tergite appearing bare, with a vaguely indicated broad band of short pale hair across the middle.

Hab.—Mt. Lamington, Papua, May, 1927 (C. T. McNamara). I have not described this at greater length because it is in most respects identical with the common Australian *M. macularis* D.T. It differs by the darker wings, the last tergite not pale haired at base, and the abdominal bands narrower. It is also very close to *M. australis* Lucas from New Caledonia but is easily separated by the yellowish pubescence. *M. captionis* Ckll. is also related, but not so closely. I hoped at first to identify this with *M. chyzeri* Friese, but the face is different, and the mandibles are not red at end.

MEGACHILE MCNAMARÆ *sp. nov.*

♀. Length about 9 to 9·7 mm.; black, including mandibles, antennæ and tegulæ; wings rather dilute fuscous, shining, violaceous, paler basally; scopa rather short and dense, entirely chocolate colour, but glistening, so that in some lights it appears pale brown; abdomen with narrow white hair-bands developed only at sides, so that they are little visible in dorsal view, and they may be absent beyond the third segment; hair on inner side of tarsi orange ferruginous; hind femora and tibiæ posteriorly with short white hair, producing a silky effect. Eyes dark brown; mandibles rather short, feebly bidentate; clypeus entirely dull, with excessively dense, partly confluent punctures, and a more or less distinct median raised line or carina, lower edge straight; vertex shining, with distinct punctures, neither vertex nor cheeks very broad, cheeks with confluent punctures; mesothorax and scutellum densely punctured, scutellum rather prominently bulging posteriorly; area of metathorax entirely dull; head and thorax with very little hair, but conspicuous pale hair on tubercles and metathorax, and forming a

white band just below the wings from tubercles to metathorax; abdomen shining, delicately punctured, last segment obliquely descending, not hairy; second cubital cell very long, receiving second recurrent nervure nearer apex than first to base.

Hab.—Mt. Lamington district, Papua, July, 7 ♀ (C. T. McNamara).

Peculiar for the short, stiff, chocolate coloured ventral scopa and the dark wings. I do not know any closely allied species.

Family XYLOCOPIDÆ.

Genus MESOTRICHIA *Westwood.*

1838. *Mesotrichia* Westwood, Trans. Ent. Soc. Lond., ii, 2, p. 112.

MESOTRICHIA FINSCHIANA (*Friese*).

1914. *Xylocopa provida* var. *finschiana* Friese, Tijds. Entom., vii, p. 61. ♀, New Britain.

Hab.—Elima to Oivi, 10.6.21, British New Guinea, ♀ (E. O. Pockley). Described from New Britain, as *Xylocopa provida* var. *finschiana*. The first intercubitus lacks the lower third. This is certainly very close to *M. perkinsi* (*Xylocopa perkinsi* Cameron), but that appears to be larger (24 mm.) and Cameron says that the upper and lower halves of the recurrent nervure form an angle at their junction, which is not true of our insect.

MESOTRICHIA BRYORUM (*Fabricius*).

1775. *Apis bryorum* Fabricius, Syst. Ent., ii, p. 381. ♂, New Holland.

Hab.—Seven females from New Guinea, Mt. Lamington, May (C. T. McNamara); Mabu Duan, April 6, and Sogeri to Port Moresby, July 26 (E. O. Pockley), and Port Moresby.

Genus LESTIS *Lepelletier.*

1825. *Lestis* Lepelletier, Encycl. Méthod. Insect., x, p. 795.

LESTIS ÆRATA *Smith* 1851 *var.* GIBBONSI *var. nov.*

♂. Black band on middle of thorax in front broader; thorax above yellowish green, the shining disc of mesothorax golden green; abdomen shining yellowish green, with strong pink and lilac suffusion; first segment with a band of peacock green along hind margin.

Hab.—National Park, N.S.W., 2.8.1914 (C. Gibbons).

Family CERATINIDÆ.

Genus ALLODAPE, *Lepelletier.*

1825. *Allodape,* Lepelletier, Encycl. Méthod. Insect., x, p. 18.

ALLODAPE SIMILLIMA *Smith.*

1854. *Allodape simillima* Smith, Cat. Hymen. B.M., ii, p. 229, n. 3. ♀, Australia.

Hab.—Two ♀ from Berowra, N.S.W., Dec. 11 (T. G. Campbell), differ greatly in size, but fall in the series I have at present as *A. simillima.* This series is so diversified that I suspect a mixture of species. Field observations and male specimens are urgently needed.

ALLODAPE UNICOLOR *Smith.*

1854. *Allodape unicolor* Smith, Cat. Hymen. B.M., ii, p. 230, n. 6. ♀, Australia.

Hab.—Two from Murray Island, Torres Straits.

Genus EXONEURA *Smith.*

1854. *Exoneura* Smith, Cat. Hymen. B.M., ii, p. 232, n. 20.

EXONEURA BICOLOR *Smith.*

1854. *Exoneura bicolor* Smith, Cat. Hymen. B.M., ii, p. 232, n. 1. ♀, Tasmania.

Hab.—Middle Harbour, N.S.W., Dec. 30, 1905, ♀ (C. Gibbons).

EXONEURA ALBOLINEATA *sp. nov.*

♀. Length about 5·5 mm.; head and thorax shining black; abdomen broad, dusky red, the base of the first tergite black, and second and third tergites with poorly defined blackish bands; labrum and mandibles red; clypeus with a very narrow creamy-white band, a little enlarged at the lower end, and surmounted by an incon spicuous transverse bar at upper; small elongate lateral face-marks next to eyes; scape light in front; flagellum entirely dark, hardly brownish beneath; tubercles black, fringed with white hair; wings hyaline; stigma large, ferruginous; nervures pale; legs black, anterior tibiæ red in front, and their tarsi rather dusky red; hind basitarsi with much stiff black hair.

Hab.—Ulong, East Dorrigo, N.S.W. (W. Heron). Easily known by the combination of linear clypeal stripe, lateral face-marks, dark tubercles and legs.

Family APIDÆ.

Genus TRIGONA *Jurine.*

1807. *Trigona* Jurine, Nouv. Méth. Class. Hymen,, p. 245.

TRIGONA PLANIFRONS *Smith.*

1864. *Trigona planifrons* Smith., Journ. Linn. Soc. Zool., vii, p. 93, n. 2. Worker. New Guinea.

Hab.—New Guinea, 19 workers. Fly River (Geo. Soc. Exp.); Mt. Lamington district, July, 1927 (C. T. McNamara); Mt. Lamington, May, 1927 (C. T. McNamara). Some are labelled No. 5. Compared with *T. canifrons* Smith, the face and front appear bare and polished, not hoary with pubescence, but in the proper light it is seen that the surface is thinly white-pruinose. There is a red spot at extreme base of antennæ. Clypeus sometimes reddish. This is the largest black species in the New Guinea fauna, the length being about or almost 6 mm. It was discovered by Wallace.

TRIGONA CINCTA *Friese.*

1898. *Trigona cincta* Friese, ex Mocsary mss. Termes Fuzeteck, xxi, p. 430. New Guinea.

Hab.—New Guinea, 15 workers. Mt. Lamington district, July, 1927 (C. T. McNamara); Mt. Lamington, May, 1927 (C. T. McNamara). Easily known by the very small size and pale yellow or whitish markings.

TRIGONA CINCTA *Friese subsp.* PERCINCTA *nov.*

Hab.—This name is proposed for the larger (about 5 mm. long) Australian race, found at Hermannsberg, Finke River. See Trans. Amer. Ent. Soc., xxxvi (1910), p. 247.

TRIGONA SAPIENS *Cockerell.*

1911. *Trigona sapiens* Ckll., Proc. Linn. Soc. N.S.W., xxxvi, p. 176. Worker, Solomon Island.

Hab.—Eleven workers from New Georgia, W. Solomons, 1925 (J. H. L. Waterhouse).

This may not be separable from *T. læviceps* Smith. I find that the front may be hairy, as described, or it may be so thinly pubescent that it seems nearly hairless. One specimen has the abdomen and hind part of the thorax reddish brown, but it is evidently immature. In fully matured specimens the abdomen is shining black.

Smith described *T. læviceps* from Malacca and New Guinea, and said that the abdomen was ferruginous, or (in his Latin description) chestnut red. At Oxford I found in the Wilson Saunders collection

T. læviceps from the Aru Islands, and the abdomen was reddish black. It seems probable that two species have been confused under this name. The male of *T. sapiens* has not been described, but I refer here eight from Lavoro Plantation, Gaudalcanal Is., Solomons (C. E. Hart). The face is narrower than in the female, the orbits strongly converging below; scape black, red at each end; flagellum long, black. The third antennal joint is extremely short; the flagellum joints have a minute reticular or scale-like sculpture. The end of the abdomen shows on each side a very long filiform lateral process, creamy-white at end (stipites); while from the extreme apex project laterally, at right angles to the axis of the body, a pair of long structures (sagittæ), broad basally, but tapering apically and very sharply pointed.

TRIGONA LAMINGTONIA *sp. nov.*

Worker. Length 6·5 mm.; head and thorax shining black, the metathorax red; abdomen narrow, shining, bright ferruginous, with the apical margins of the segments narrowly but conspicuously blackened; tubercles red; tegulæ dark rufo piceous; wings dusky (blackish not yellowish), stigma large and black; legs black, tarsi more or less reddened at tips; hind tibiæ very broad, with a fringe of black hair. Head large, face broad, not conspicuously hairy, but looked at obliquely from above the sides of the face appear greyish from fine tomentum; mandibles pale red, darker at apex, apical margin rounded, but the inner corner with a prominent tooth; malar space well developed, but broader than long; flagellum light ferruginous beneath, very dark above; scape black, red at extreme base, and slightly so at apex; mesothorax polished, more or less reddened along hind margin; dark hair of scutellum very thin and short.

Hab.—Two workers. Type from Mt. Lamington, May, 1927 (C. T. McNamara); the other Mt. Lamington district, July, 1927 (C. T. McNamara) New Guinea. Nearest to *T. flaviventris* Friese, but shining, the clypeus not yellowish, and the abdomen with linear dark bands.

TRIGONA CARBONARIA *Smith.*

1854. *Trigona carbonaria* Smith, Cat. Hymen. B.M., ii, p. 414, n. 44. Worker. Australia.

Hab.—Ourimbah, N.S.W., Nov., 1906 (C. Gibbons); National Park, N.S.W., Dec. 17, 1905 (C. Gibbons).

STUDIES IN AUSTRALIAN ATHECATE HYDROIDS.

No. II. Development of the Gonophores and Formation of the Egg in *Myriothela australis*, Briggs.*

By

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(Plates xlii-xliv, and Figures 1-4.)

Introduction.

Previous to the publication of Benoit's exhaustive researches into "L'Ovogénèse et Les Premiers Stades du Développement chez La Myriothèle et chez La Tubulaire,"[1] our knowledge of the more salient features in the development of the gonophores of *Myriothela* was based on the works of the earlier investigators, in particular Allman (1875), Korotneff (1880 and 1888), and Hardy (1891). Although Labbé (1899), in his work on *Myriothela* and *Tubularia* studied the oogenesis of these genera in more or less detail, he assumed that the origin of the germ-cells and the development of the gonophores were sufficiently well established to enjoin no further investigation into these problems. Consequently he confined his attention almost exclusively to the mode of formation of the egg, but from his observations was unable to reconcile this with the normal cycle of oogenesis in the Metazoa.

Unfortunately Jäderholm's excellent description of the structure and histology of *M. austro-georgiæ*[2] does not include an account of the development of the gonophores in this diœcious species. He has confined himself solely to figuring the immature male and female gonophores as they appear in longitudinal sections. This is all the more to be regretted in view of the fact that the Australian species of *Myriothela, M. australis* and *M. harrisoni*,[3] are also diœcious, whereas the northern forms, *M. phrygia* and *M. cocksi,* are characterized by their monœcious condition. Benoit has observed and described for the first time the process of fertiliza-

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* For No. I see "Records of the Australian Museum," Vol. xvi, No. 7, 1928, p. 305.

[1] Benoit.—Archiv. de Zool. Exp. et Gén., lxiv, 2, 1925.

[2] Jäderholm.—Wiss. Ergebn. d. schwedischen Südpolar-expedition, 1901-1903, v, 8, 1905.

[3] Briggs.—Rec. Austr. Mus., xvi, 7, 1928.

tion in *M. cocksi*. The ripe spermatozoa escape from the cavity of the male gonophore and passing down the gastric cavity in the peduncle of this gonophore enter the gastric cavity in the peduncle of the female gonophore, and so reach the cavity of the female gonophore containing the mature ovum which, at this stage, has not yet been expelled.

Since the male and female gonophores of *M. australis* and *M. harrisoni* are always carried on separate individuals, the process of fertilization in these species appears to demand a different method to the one described by Benoit for *M. cocksi*. The presence of an apical aperture in both the male and female gonophores of *M. australis* and *M. harrisoni* is, I think, to be correlated with the method of fertilization, and I venture to suggest that in these Australian species the ripe spermatozoa are able to make their escape through the opening at the distal pole of the gonophore and so reach the surrounding water. These sperms carried by the currents to the female gonophores enter through the apical aperture and effect the fertilization of the mature ovum. Should this view of the method of fertilization in the Australian representatives of the genus *Myriothela* prove to be the correct one, then a similar condition of the distal pole would be expected to exist in the male and female gonophores of *M. austro georgiæ*. Jäderholm's figures, however, depict the gonophores of his Antarctic species as spherical structures without a trace of any such apical opening, although his Figure 1 on Plate iii shows a slight but definite thickening of the ectoderm at the summit of the female gonophore. I regard this gonophore as immature, since the sub-umbrellar cavity appears to be filled with cytoplasmic areas and primary oocytes. In this event it undoubtedly represents a stage before the ectoderm invaginates to form the velar aperture.

A perusal of the early literature dealing with the important question of the development of the gonophores in *Myriothela* immediately reveals a mass of conflicting data as well as a number of contradictory views not only on the origin of the primitive germ-cells but also on the formation of the early developmental stages. The problem has been made all the more difficult because the first investigators failed to recognize that there were two distinct, yet very closely related species, *M. phrygia* and *M. cocksi*, on which to base their observations. This fact may account in some degree for the discrepancies noticed in the following summaries from the writings of Allman, Korotneff, and Hardy. Their conclusions are here set forth at considerable length in order that the stages in the development of the gonophores of *M. australis* may be the more readily understood when compared with those in the northern forms.

I. According to Allman's account,[4] the first appearance of the gonophore in *Myriothela* shows itself as a small evagination from

[4] Allman—Phil Trans., clxv, 1875

the endoderm of the blastostyle. This grows outwards into the ectoderm, carrying with it the endoderm, but separated from the former by the supporting lamella. The extremity of this endodermal diverticulum soon becomes excavated by a spherical cavity which Allman calls the *gonogenetic cavity*. The evagination increases in size, and continues to press the ectoderm before it. The gonogenetic chamber becomes crescentic in shape, while a minute orifice makes its appearance in the summit of the chamber. The ectoderm, however, remains imperforate.

In the female gonophore the floor of the gonogenetic chamber projects further into its interior in the form of a hollow conical spadix. This chamber now becomes filled with a plasmatic mass consisting of a multitude of very small nuclei, each enclosing a minute nucleolus, and immersed in a minutely granular protoplasm. As development proceeds, each nucleus becomes surrounded by a differentiated mass of protoplasm, and the cavity of the gonophore is filled with bodies which possess all the characteristic features of true ova. These continue to increase in size, pressing against one another and thus coming to acquire a polyhedral form; then they gradually become looser and assume finally an oval shape. The male gonophore resembles the female in all points except in being about half the size of the latter, and Allman "could detect no difference as to the origin between the matter which in one case is to be differentiated into ova, and that which in the other is destined for the formation of spermatozoa."

II. Korotneff's early work on *Myriothela* published at Moscow and printed in the Russian language is not available to me; I am, therefore, indebted to Benoit's comprehensive treatise for the following summary of Korotneff's views on the origin of the primitive germ-cells in *Myriothela*.

Korotneff, before any indication of evagination is apparent, recognized the initial cells concerned in the development of the sexual products as large, granular, endodermal cells, cubic or polygonal in outline, which occupy a position against the supporting lamella. These cells divide, forming a large mass which causes the supporting lamella and ectoderm to bulge outward so as to produce a bud entirely endodermal in origin. As the bud increases in size, the ectoderm covering it becomes very thin and reduced to a single layer of epithelial cells. The peripheral cells of the bud then elongate and form an outer covering which is the *Anlage* of the future envelope of the egg. The central cells, cut off from the adjacent cells by a non-cellular layer, multiply and are concerned entirely with the formation of the egg. The male reproductive cells, like those of the female, are also endodermal in origin. Korotneff, according to Benoit, concludes with the remark: "Nous pouvons dire avec certitude absolue que les products génitaux mâles et femelles se développent aux dépens d'éléments embryonnaires de l'endoderme."

Later, in 1888, Korotneff published a second paper, "Contribution à l'étude des Hydraires,"[5] in which he completely reverses his opinion concerning the endodermal origin of the primitive germ-cells, and derives them from the ectoderm of the blastostyle. From an examination of stages earlier than those he had previously worked with, Korotneff describes the formation of a hollow endodermal evagination which penetrates deeply into the ectoderm. The latter is composed of three layers of cells—(1) epithelial, (2) embryonal, and (3) muscular. The embryonal layer gives origin to the reproductive elements, and consists of a mass of cells whose central one, distinguished by its very large size and conspicuous nucleus, represents the primordial germ-cell. This divides to form the germ-cells and is completely surrounded by the vitelline cells.

III. Hardy has described a process of budding in *Myriothela*.[6] The buds arise at the junction of the stolon and body where they may be observed in various stages of development. The first stage is a modification of the character of the ectoderm cells which lose their defined character, proliferate, and a bulging mass of amorphous tissue results. At the same time the thick supporting lamella becomes absorbed, and the endoderm cells likewise proliferate and take on an amorphous character. There is thus formed a kind of blastema in which the limits of ectoderm and endoderm are indistinguishable. The blastema increases in size pushing the perisarc before it, and ultimately forms a rounded egg-like mass attached to the parent-body by a short thick peduncle. The bud soon loses its connection with the body of the parent, but remains attached to the perisarc by a sucker-like arrangement at the aboral pole until it is fully formed.

According to Hardy the formation of the gonophore is, in its earliest stages, essentially similar to this method of budding. Thus the gonophore is a true bud derived from a blastema formed by the fusion of the ectodermal and endodermal elements. The ectoderm of the gonophore-bearing region becomes thickened owing to the accumulation of the primitive germ-cells. Then the basement membrane is absorbed or ruptured, and the endoderm pushes its way into the ectoderm so that the group of primitive germ-cells comes to lie on one side of the evagination. In the next stage the germ-cells become cut off from the maternal tissue by the formation of a supporting lamella. Very soon the male gonophores become distinguished by the rapid proliferation of their generative elements.

IV. Benoit, working on *Myriothela cocksi* (Vigurs) from Roscoff and L'île Ti-sao-son, concludes that the first appearance of the gonophore *always* begins as an evagination from the endoderm of the blastostyle, and penetrates deeply into the ectoderm which, however, remains absolutely inactive and takes no part in the forma-

[5] Korotneff.—Archiv. de Zool., Exp. et Gén., vi, 2, 1888.
[6] Hardy.—Quart. Journ. Micro. Sci. (n.s.), xxxii, 1891.

tion of the gonophore at this stage. The *Glockenkern* (nodule médusaire of Benoit) arises from an interstitial cell whose position has already been definitely established in the axis of the evagination. This cell occupies the apex of the endodermal evagination, and divides to form a rounded mass of cells which become cut off from the rest of the endoderm by the formation of a thin non-cellular layer. The *Glockenkern* increases in size by the absorption of nutritive material from the gastric endoderm, and its cells force their way still deeper into the ectoderm. At this stage a split occurs in the cells of the *Glockenkern* so that a small central cavity is formed which later becomes the sub-umbrellar cavity of the gonophore. At first spherical, this cavity becomes flattened and finally crescentic in shape due to pressure exerted by the underlying endoderm which now gives rise to the spadix. By the proliferation of the endoderm-lamella there are formed the rudiments of the circular canal and the radial canals. At this stage the differentiation of the gonophores into male or female is established. The male germ-cells arise from the epithelial layer covering the spadix. The nuclei of these cells divide directly to form the spermatogonia. Then the germinal mass increases in size, while the epithelium in the upper part of the cavity comes into close contact with the endoderm lamella to form the epithelium of the sub-umbrellar cavity. Owing to the very small size of the germ-cells Benoit experienced considerable difficulty in following through the stages of spermatogenesis, but he was able to recognize primary and secondary spermatocytes, spermatids, and spermatozoa provided with very long tails. Spermatogenesis begins in the periphery of the germinal mass and proceeds progressively towards the inner part in the neighbourhood of the spadix.

The female gonophore is readily distinguishable from the male gonophore by reason of the much smaller number of sexual products. The female germ cells give rise by mitosis to the oogonia which multiply and reach a considerable size forming the primary oocytes. The manubrium appears very much later in the female gonophore than it does in the case of the male. Moreover, the female gonophore is less highly specialized since it develops neither circular nor radial canals. The gastric endoderm of the spadix in the female gonophore is always well developed, presenting numerous villi which almost completely fill the gastric cavity of the gonophore.

Development of the Gonophores in Myriothela australis.

The fully-developed blastostyle has a narrow base of attachment to the proximal end of the hydranth, and a club-shaped extremity on which is borne a cluster of capitate tentacles. The blastostyle has no mouth, but contains an extensive gastric cavity communicating with the general body-cavity of the hydranth. In the male, the blastostyle bears terminally some six to nine capitate

tentacles, while in the female the swollen head is provided with eight to ten tentacles.

In *M. australis* all the gonophores on a blastostyle are of the same sex, and throughout any one individual the sex of the gonophores is uniform. The mature gonophores are spherical in form, supported on narrow cylindrical peduncles which spring without any definite arrangement from the sides of the blastostyles. The immature gonophores are borne on the proximal part of the blastostyle with the mature ones towards the distal extremity. In the female there are usually three or four mature gonophores near the distal end and some six to eight immature ones on the proximal side of these. In the male the gonophores are more numerous though slightly smaller than those in the female, up to fifteen occurring on a single blastostyle.

Development of the Male Gonophores.

Owing to the fairly advanced state of the material at my disposal, I am unable to give an account of the first appearance of the gonophore which, according to Benoit, always begins as an evagination of the endoderm of the blastostyle. This penetrates deeply into the ectoderm, and the interstitial cell at the apex of the evagination divides to form a rounded mass of cells which becomes cut off from the rest of the endoderm by the formation of a thin, non cellular layer.

This condition in the development of the gonophore is represented by the earliest stage in my material (Pl. xlii, fig. 2). The gonophore appears here as an endodermal evagination consisting of a mass of cells which has penetrated deeply into the ectoderm and become cut off by the formation of a definite, non cellular layer. The ectoderm surrounding this mass of cells remains stratified and heavily charged with large, oval nematocysts, except over the outer surface of the evagination where the ectoderm is reduced to a single layer of epithelial cells. The pressure exerted by this penetration causes the ectoderm to bulge outwards so that even at this early stage in the development of the gonophore the ectoderm appears slightly raised above the general surface of the blastostyle.

The *Glockenkern*, thus established, increases in size and a split occurs in the cell mass where a small central cavity is formed. As this enlarges, the cells become arranged in a single layer surrounding a spherical chamber which constitutes the *Anlage* of the subumbrellar cavity (Pl. xlii, fig. 2). This very soon becomes flattened and appears semicircular in section with its floor composed of a layer of cells which quickly become differentiated from those occupying the two lateral wings (Pl. xliii, fig. 1).

At this stage, owing to the rapid growth of the gonophore, the ectoderm is forced outwards and forms a distinct projection on the surface of the blastostyle. The gonophore, thus coming to project

completely on the exterior, is covered by ectoderm which is reduced to a single layer of cubical cells over the summit, but which remains as a stratified layer rich in nematocysts around the base (Pl. xliii, fig. 1).

The gastric endoderm now begins to proliferate rapidly, forming numerous villi that project into the gastric cavity and reduce considerably the extent of its lumen. As this cavity continues to enlarge, the endoderm cells become heavily charged with nutritive spheres which form a very important nutritive material for the development of the gonophore. The outgrowth of the gastric endoderm gives rise to the manubrium. This forces back the cells on the floor of the sub-umbrellar cavity, thus reducing the cavity to a narrow cleft of crescentic form with its horns prolonged laterally over the sides of the manubrium.

Owing to the internal pressure produced by the outgrowth of the spadix, the endoderm-lamellæ occupying the roof of the sub-umbrellar cavity commence to separate in the axis of the gonophore. At this point the endoderm-lamellæ eventually become widely separated leaving a distinct gap (Pl. xlii, fig. 1). In *M. cocksi,* Benoit has described a similar separation of the endoderm-lamellæ, but the gap forms a funnel which becomes filled with a non-cellular substance. In *M. australis,* at this stage, the gap remains open while the endoderm cells surrounding it proliferate and arrange themselves in two layers. It is during this period in the development of the gonophore in *M. cocksi* that the cells become excavated to form the circular canal, but in *M. australis* the cells remain solid, forming a compact mass, and the circular canal fails to develop (Pl. xlii, fig. 1).

At the same time the cells occupying the two lateral wings of the sub-umbrellar cavity form an epithelium which becomes closely applied to the endoderm except in the axis of the gonophore. Here the cells of the sub-umbrellar epithelium enter the gap between the endoderm-lamellæ and come into close contact with the ectoderm (Pl. xlii, fig. 1). Throughout the whole of its extent the sub-umbrellar epithelium is separated from the other cell-layers by a very thin layer of supporting lamella.

The outgrowth of the manubrium also affects the cells on the floor of the sub-umbrellar cavity, causing them to form a crescent-shaped mass over the surface of the spadix. From the cells of this layer are derived the male reproductive elements. An examination of the gonophore at this stage discloses that it has assumed a spherical form and developed a narrow cylindrical peduncle by which it retains its connection with the blastostyle (Pl. xlii, fig. 3). At the distal pole of the gonophore the ectoderm has become raised into a small circular patch composed of deep columnar cells lying directly above the gap between the endoderm-lamellæ (Pl. xlii, fig. 1).

The first stage in spermatogenesis begins in the mass of cells covering the spadix and is accompanied by a rapid multiplication of their nuclei. Then the cytoplasm breaks up and comes to surround each nucleus, forming the spermatogonia in the central part of the mass (Pl. xliii, fig. 1). These cells are quite unlike those of the gastric endoderm, thus offering a marked contrast to the condition that exists in *M. cocksi*. In this species Benoit found that the central part of the germinal mass presented an appearance very like that of the cells in the gastric endoderm due to the presence of large quantities of nutritive material.

The layer of spermatogonia increases in extent, and by rapid division the spermatogonia give rise to the primary spermatocytes (Plate xlii, fig. 3). From these are derived the secondary spermato cytes which almost completely fill the sub-umbrellar cavity (Pl. xliii, fig. 2). They are very small and measure only 3 μ in width. The gonophore has now acquired its definitive dimensions and has a diameter of 700 μ. At the distal pole, the raised patch of ectoderm lying directly above the gap between the endoderm-lamellæ becomes invaginated at the centre to form a small pit-like depression which breaks through into the sub-umbrellar cavity. The velar aperture thus established is lined by a deep columnar epithelium whose cells are derived from the ectoderm (Pl. xliii, fig. 2).

Owing to the absence of a more advanced stage amongst my material, I am unable to describe the formation of the spermatids and the condition of the ripe gonophore. In the case of *M. cocksi*, Benoit remarks that "La *spermiogénèse* est très difficile à observer; on voit seulement dans un gonophore mâle mûr une infinité de *spermatozoides* formés d'une tête très chromatique et piriforme de 1 μ de longueur à l'arrière de laquelle se trouve un centrosome color able, d'où part un *flagelle* très long formant l'axe de la queue du spermatozoide qui puet atteindre 20 μ. Ces spermatozoides sont groupés en faisceaux à queues parallèles et dans les différentes directions."

I have no observations on the mode of escape of the sperms from the gonophore, but I venture to suggest that the ripe spermatozoa are discharged through the velar aperture, and not through the gastric cavity in the peduncle as observed by Benoit in his specimens of *M. cocksi*.

Development of the Female Gonophores.

The material at my disposal for the study of the female gono phores, while not so complete as for the males, is sufficient to enable me to give an account of the main features of their development. Several blastostyles bearing female gonophores in their middle and late stages of development have been studied entire and in serial sections cut in two directions, transversely and vertically, with a thickness of 6 μ.

My first stage is already well advanced and appears as a rounded outgrowth from the wall of the blastostyle. The ectoderm of the gonophore is reduced to a single layer of cells over the distal pole, but elsewhere remains stratified and is richly provided with large, oval nematocysts. The cells of the germinal mass are arranged in several layers; those in the outer layer have very small nuclei and form the external epithelium of the future spadix, while the others in contact with the very thin underlying supporting lamella are distinguished by their much larger nuclei. They are the mother-cells of the future reproductive elements and represent the oogonia. As these oogonia increase in number, the cells of the gastric endoderm rapidly divide and form numerous villi which become heavily charged with nutritive spheres.

In the following stage, an evagination of the endoderm cells at the distal end of the gastric cavity forms the manubrium. This outgrowth carries the cells of the germinal mass before it, and the sub-umbrellar cavity consequently undergoes a considerable reduction in size. At the same time the germinal mass is driven forward at its central part so that in vertical section it appears as a crescentic patch of cells covering over the outer surface of the manubrium. The gonophore is now represented by a fully formed spherical body, 250 μ in diameter, united with the blastostyle by a short, stout peduncle. Over the distal pole extends a single layer of ectoderm composed of cubical cells, but the rest of the external wall still remains stratified and contains numerous nematocysts.

As the gonophore continues to increase in size, the oogonia multiply *pari passu* until they come finally to fill the entire space between the sub-umbrellar epithelium and the manubrium. When viewed in vertical section, the oogonia are seen to be arranged in a crescent-shaped mass with the horns prolonged for a considerable distance over the lateral regions of the manubrium. The gastric endoderm presents a very characteristic appearance due to the development of the villi which completely fill the gastric cavity (Pl. xliv, figs. 1 and 4). The cells are crowded with nutritive spheres, probably of a lipoid nature, forming a very important nutritive substance for the development of the gonophore.

The oogonia multiply and increase in size to give rise to the primary oocytes which press closely against one another and assume a polygonal form. Each primary oocyte (Pl. xliv, fig. 3) consists of a large cell, 24 μ in diameter, with a large, eccentrically-placed nucleus of 12 μ diameter. The nucleolus is 4 to 5 μ in diameter, and is formed of dense chromatin. Around the nucleolus is a clear zone beyond which is a fine network of threads carrying numerous chromatin granules close against the nuclear membrane. Some of these granules appear to have passed out from the interior of the nucleus, since they occur in considerable numbers either attached to the outer surface of the nuclear membrane or at some distance from it in the cytoplasm.

Although the female gonophore has not yet acquired its definitive dimensions, it will be convenient at this stage to discuss the formation of the egg which now involves the fusion of the primary oocytes in the sub-umbrellar cavity. In *Myriothela*

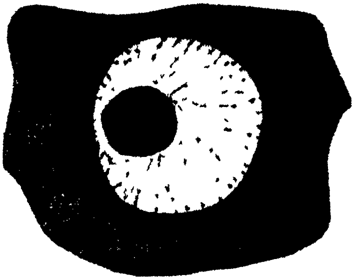

Figure 1.
Myriothela australis, Briggs. Primary oocyte.

australis, egg formation begins at a stage when the major portion of the gonophore is occupied by the gastric endoderm whose numerous villi completely fill the gastric cavity. The primary oocytes are similar in size and structure, forming a mass of cells which is bounded above and at the sides by a very thin layer of sub-umbrellar epithelium, and below by the supporting lamella and the endoderm of the spadix (Pl. xliv, fig. 4).

Formation of the Egg.

I.—*General.*

The study of egg-formation in the members of the genus *Myriothela* raises several important questions, including the history of the cytoplasmic inclusions of the egg during oogenesis. The problem, which has been made the subject of extensive researches by Allman, Korotneff, Labbé and Benoit, presents a number of difficulties since the formation of the definitive egg in *Myriothela* may be brought about in three distinct and apparently unrelated ways. Firstly, the formation of the egg from a plasmodium has been observed by Korotneff (1880), Labbé, and Benoit. Secondly, the formation of the egg from plasmodial areas has been described by Allman, Korotneff (1888), Labbé, and Benoit. Finally, the formation of the egg by plasmolysis has alone been noted by Labbé.

The first account of the process of egg-formation as it occurs in the case of *M. cocksi* (Vigurs) appeared as early as 1875 in Allman's monograph "On the Structure and Development of *Myriothela*." When the primary oocytes have acquired their full

size they begin to undergo a fusion and may be seen united to one another by irregular pseudopodia-like extensions. By the shortening and thickening of these processes the masses are drawn together and become fused into a common protoplasmic mass with numerous nuclei scattered through its substance. The fusion commences among the primary oocytes in the immediate vicinity of the spadix, and continues until eight or more oval masses are formed in the sub-umbrellar cavity. These separate protoplasmic masses increase in size, then coalesce with one another, and finally form a single large plasmodium which entirely fills the cavity of the gonophore.

According to Korotneff's earlier work, a cell situated at the summit of the spadix acquires a more granular cytoplasm which differentiates it from the other cells. This cell increases greatly in size then fuses with the neighbouring cells, the peripheral ones fusing last of all to form the definitive egg.

Later, Korotneff (1888) recognized two kinds of cells in the gonophore: the germinal cells and the vitelline cells. Of these germinal cells, one forms the large *mother-cell* distinguished by its extremely large nucleus, while the others increase in size but their nuclei tend to degenerate and disappear. The nuclei of the vitelline cells become transformed into fat or yolk globules. The definitive egg is formed by the fusion of all these various elements.

Hardy's brief reference to egg-formation throws no fresh light on the problem. He is content to state merely his observations as follows: "In the female gonophore at some period, often relatively late, two or three of the generative cells become larger and more prominent than the others. The period at which this happens does not appear to be fixed, and whatever factor it may be, whether something inherent or accidental, that determines which of these struggling cells shall obtain the mastery and eat up its fellows, it sometimes does not come into play until the gonophore has become a well-formed structure. But it is quite late in the history of the gonophore, when the structure is large and already swollen with yolk, before these two, three or four cells, which, so to speak, have succeeded in attaining to the final heat, decide who is the winner."

Labbé[7] considers that the formation of the egg may be brought about in three ways—(*a*) from a plasmodium, (*b*) from plasmodial areas and (*c*) by plasmolysis.

The formation of the egg from a plasmodium occurs at a stage when the gonophore is filled with free oocytes. These have an active amœboid movement and their pseudopodia fuse in such a manner that vacuoles are left between them. Some of the nuclei now increase in size while the others degenerate. Finally, only a single nucleus remains and this forms the germinal vesicle of the egg. The other nuclei degenerate and produce the "Pseudozellen."

[7] Labbé.—Archiv. de Zool., Exp. et Gén., vii, 8, 1899.

The most frequently observed method of egg-formation occurs from the fusion of several plasmodial areas. These increase enormously in size by the formation of vacuoles. All the nuclei, with the exception of one or two which become very large, give rise to the "Pseudozellen." The nucleus which persists becomes the germinal vesicle. The complete fusion of the plasmodial areas produces the mature ovum.

Labbé has also observed a third method of egg-formation by plasmolysis. In this case the oocytes which surround the spadix and those which occur on the periphery of the gonophore are not involved in the plasmolysis, and by their fusion give rise to the formative plasma of the egg. In these oocytes the nuclei degenerate with the exception of a single one which becomes the germinal vesicle. The other oocytes undergo plasmolysis and form the nutritive material for the egg.

In *M. cocksi* (Vigurs), Benoit describes egg-formation as taking place by two totally distinct methods:

I. The egg arises from a primary oocyte situated in the axis of the gonophore close to the spadix. The cell increases in size, then fuses progressively with the neighbouring cells to the right and left until there remains only an outer layer of oocytes which are finally incorporated to form the definitive egg.

II. The egg arises from several primary oocytes situated at the distal end of the spadix. These cells increase in size and form several distinct cytoplasmic zones. Each of these becomes a plasmodial area by its fusion with the neighbouring oocytes. The plasmodial areas, to the number of five or six, are at first completely separated by thin, non-cellular partitions extending from the spadix to the epithelium of the sub-umbrellar cavity. As these partitions recede towards the periphery, the plasmodial areas fuse into the large definitive egg which is surrounded by a thin envelope of mesoglœa.

Benoit concludes that the primary oocytes which fill the sub umbrellar cavity of the female gonophore have been formed *in situ* and are not amœboid cells. The "pseudocellules" are derived from the nuclei of the primary oocytes that fuse to form the definitive egg. In the early stages of egg-formation, the degeneration of the nuclei is rapid and complete, producing spherules or very small granules. In the later stages of the formation of the egg, the nuclei undergo an incomplete degeneration and are always recognizable, forming later the vitelline material of the mature ovum.

The formation of the egg in *Myriothela* reproduces the normal cycle of oogenesis of the Metazoa. In the young gonophore, the floor of the *Glockenkern* is formed from the primitive germ cells which by multiplication give rise to the oogonia. These always

divide by mitosis and the last generation forms the primary oocytes which fill the cavity of the adult female gonophore. All the primary oocytes finally degenerate with the exception of a single one which forms the definitive egg.

II.—*Egg-Formation in Myriothela australis.*

We have left the development of the female gonophore in *M. australis* at a stage when the major portion of the gonophore is occupied by the gastric endoderm whose villi completely fill the gastric cavity. The primary oocytes are similar in size and structure, forming a mass of cells which is bounded above and at the sides by a very thin layer of sub umbrellar epithelium, and below by the supporting lamella and the endoderm of the spadix (Pl. xliv, fig. 4).

The first appearance of egg-formation occurs among the primary oocytes situated in the lower layers of the cell-mass which occupies the region directly above the distal extremity of the spadix. Here two primary oocytes come into close contact and their cytoplasm fuses to form a cytoplasmic mass in which the two nuclei, after undergoing a slight degeneration, persist for a time. This fusion between the cytoplasm of two primary oocytes, initiated at the apex of the manubrium, soon extends to the oocytes surrounding the lateral regions of the spadix, and the sub umbrellar cavity gradually fills with a number of small cytoplasmic areas (Pl. xliv, fig. 1). These in turn increase in size, not by the formation of vacuoles, but by accretion either of new primary oocytes, or of the previously formed, small cytoplasmic areas.

The larger areas thus produced have well defined outlines, and in each the eccentric nucleus is discernible as an oval body enclosed by a slightly wrinkled, deeply-staining, nuclear membrane (Pl. xliv, fig. 5). Surrounding the nucleus is a very fine layer of cytoplasm containing scattered basophilic granules. At this stage the gonophore is represented by a spherical body, 600 μ in diameter, completely surrounded by a single layer of cubical ectoderm cells, and united with the blastostyle by a long, narrow, cylindrical peduncle.

As the primary oocytes continue to fuse with the cytoplasmic areas, their nuclei undergo an immediate and complete degeneration, and soon these areas have absorbed all the oocytes with the exception of those in the outer part where they remain for a short time as a kind of covering layer. When viewed in vertical section, the areas are seen to be arranged in some eleven to twelve distinct masses which cover the apex of the manubrium and extend for a considerable distance over its lateral regions. When the last of the primary oocytes fuse with the cytoplasmic areas, their nuclei remain recognizable for a time then undergo an incomplete degeneration, and represent the "Pseudozellen" of the mature ovum.

The gonophore has now acquired its definitive dimensions and has a diameter of 800 μ. At the distal pole, the cubical cells of the outer wall have deepened and formed a raised circular patch of ectoderm which now becomes invaginated at the centre to form a small pit-like depression. This breaks through into the sub-

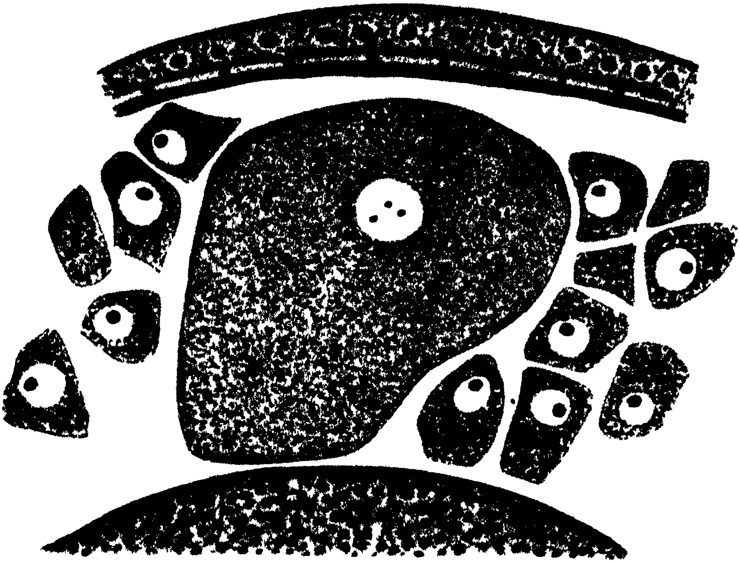

Figure 2
Myriothela australis. Briggs Cytoplasmic area and primary oocytes in the sub-umbrellar cavity

umbrellar cavity, and the velar aperture thus established is lined by a deep columnar epithelium whose cells are derived from the ectoderm.

The final absorption of the primary oocytes into the cytoplasmic areas is very shortly followed by the fusion of the areas themselves, so that there are present in the gonophore some five or six large plasmodial areas completely separated from one another by thin, non-cellular partitions which extend from the spadix to the epithelium of the sub-umbrellar cavity. By means of these partitions, the sub-umbrellar cavity is divided into a number of chambers each enclosing a plasmodial mass which has the appearance of a complete egg with its nucleus and nucleolus.

The last phase of egg-formation involves the withdrawal of these partitions and the fusion of the plasmodial areas. This begins at the surface of the spadix, and as the partitions recede towards

the periphery of the gonophore, the plasmodial areas come into close contact with one another and immediately fuse together (Pl. xliv, fig. 2). At the same time the egg increases in volume and exerts a strong pressure on the spadix which is finally driven back com-

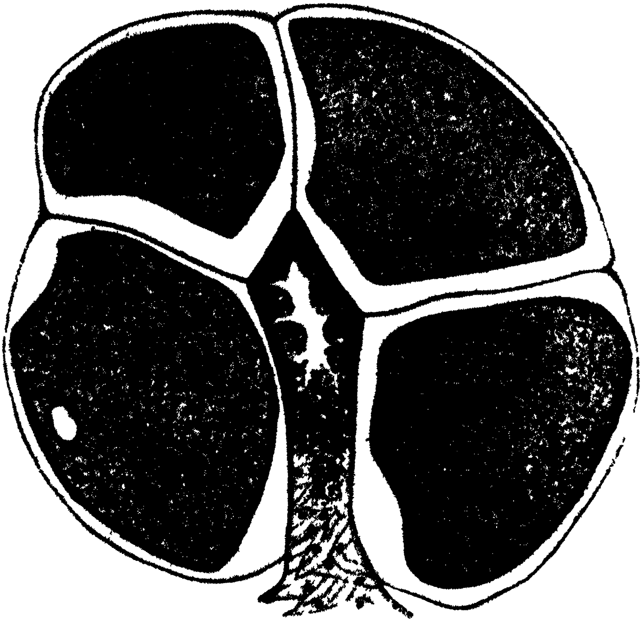

Figure 3.
Myriothela australis, Briggs. Four plasmodial masses completely separated by thin, non-cellular partitions which extend from the spadix to the epithelium of the sub-umbrellar cavity. The outer wall of the gonophore has been omitted.

pletely into the gastric cavity of the blastostyle. At that moment the non-cellular partitions have entirely disappeared, the plasmodial areas have fused into a single, compact mass, and the large definitive egg has completed its growth and occupies the whole of the interior of the gonophore (Plate xliv, fig. 2).

The cytoplasm of the mature ovum contains numerous basophilic granules derived from the complete degeneration of the nuclei of the fused primary oocytes. The "Pseudozellen" ("Pseudocellules" of Benoit) arrange themselves close to the periphery of the cell where they have arisen from the slightly degenerate nuclei of the primary oocytes which were the last to fuse with the cytoplasmic areas. The cytoplasm becomes charged with yolk. This

constitutes the deutoplasm of the egg, although this term is equally applicable to other secondary products of the protoplasm.

III.—*The Pseudozellen (Pseudocellules).*

The cytoplasmic inclusions of the egg comprise the yolk bodies and the Pseudozellen (Pseudocellules). Labbé and Benoit have recognized the true nature of the Pseudozellen in *Myriothela,* since both these writers describe them as the slightly degenerate nuclei of the primary oocytes which were the last to fuse with the plasmodial areas. This interpretation has also been put forward by Doflein (1896),[8] Gröneberg (1897),[9] and Pérez (1913),[10] whose works on the athecate genus *Tubularia* clearly support this view.

With regard to the formation of the yolk, Labbé holds that the Pseudozellen undergo degeneration accompanied by a process which he terms karyolysis, and so give rise to the nutritive material of the egg in the form of yolk globules or yolk bodies. In a summary of his views regarding the fate of the Pseudozellen, Labbé states: "Si nous résumons cette question des Pseudozellen, nous voyons que ce sont des éléments morts: oocytes entiers en plasmolyse, ou noyaux d'oocytes dégénérés; et que, très vraisemblablement, ces Pseudozellen de l'œuf des Hydraires jouent, comme l'ont pensé la plupart des auteurs, le rôle de globules vitellins ou de balles vitellines, constituant par conséquent les éléments de réserve de l'œuf mûr." From Labbé's account it would appear that the Pseudozellen degenerate and form the deutoplasm of the mature ovum.

Benoit contends that the nuclei of the primary oocytes are transformed into a refringent mass of chromatin which divides into a number of small spheres each surrounded by a clear zone. By the rupture of the membrane of the Pseudozelle, these spheres are set free in the centre of the egg where later they increase in size and multiply by division to form the vitelline material of the mature ovum. Benoit, however, does not accept Labbé's conclusion that the nutritive material is composed of "éléments morts," but holds that it is "un matérial *bien vivant,* que nous verrons se multiplier par accroissement, suivi de division."

The formation of the yolk, according to Benoit's point of view, involves the breaking up of the Pseudozellen into spherules of varying sizes. The large spherules then subdivide into a number of small spherules which erupt into the cytoplasm of the egg where they form a reserve supply of vitelline material. In his chapter on the fertilization of the egg of *Myriothela,* Benoit returns to the question of yolk formation and again stresses the presence of these spherules which constitute the vitelline material, formed by the division of the Pseudozellen.

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[8] Doflein.—Zeit. f. Wiss. Zool., xlii, 1896.
[9] Gröneberg.—Zool. Jahrb., Abth. Anat. xi, 1897.
[10] Pérez.—Bull. Sci. France et Belgique, xlvi, 1913.

In the unfertilized eggs of *M. australis*, the Pseudozellen lie in the outer part of the cytoplasm where they undergo no further change and remain easily recognizable as distinct nuclei, each with a clearly-defined nucleolus. A similar condition of the Pseudozellen has been described in the unfertilized eggs of some species of *Tubularia*. Owing to the absence of more advanced stages I am unable to follow the subsequent history of the Pseudozellen, but Pérez's description of their fate in *Tubularia* shows that their ultimate transformation only really begins in advanced embryos after the endoderm has become established. As a result of segmentation, the majority of the Pseudozellen are relegated to the endoderm where they are finally digested. In the ectoderm, where they are fewer in number, the Pseudozellen remain almost unaltered until driven out to the vicinity of the free surface. Even in the endoderm there are some Pseudozellen which persist in an almost unaltered condition, but these are finally forced into the gastric cavity and then to the exterior when the actinula is set free. In conclusion Pérez states: "Il semble donc que les pseudocelles n'apportent à l'œuf qu'un supplément assez médiocre de matériaux nutritifs, et qu'elles ne doivent pas être, sans restriction, comparées aux réserves vitellines ordinaires."

IV.—*History of the Yolk.*

The question of yolk formation is of paramount importance in the study of oogenesis. The material at my disposal, however, does not permit of a thorough examination of the cytoplasmic inclusions, especially the mitochondria, of the egg owing to the use of unsuitable fixatives such as 70% alcohol and sublimate-acetic alcohol.

From the statements of Labbé and Benoit quoted in the previous section it will be seen that both these authors derive the yolk from the division of the Pseudozellen. Benoit, in fact, has given a most circumstantial account of his observations on the subdivision of the Pseudozellen into spherules which erupt into the cytoplasm and form a reserve supply of vitelline material.

No signs of any changes in the Pseudozellen such as those observed by Labbé and Benoit were found in the eggs of *M. australis*, and as far as I am able to determine there is never any observable connection between the Pseudozellen and the yolk bodies.

Evidence on yolk formation in other Hydroid Zoophytes has been derived from the study usually of a single form, and the results at the present time are very contradictory. Hargitt (1913)[11] in his studies on the "Germ Cells of Cœlenterates" has paid particular attention to the formation of yolk in the eggs of *Campanularia flexuosa*. When first observed, the yolk bodies are in

[11] Hargitt.—Journ Morphol., xxiv, 1913

greatest number near the periphery of the egg, but as these bodies become more abundant they are present near the nucleus as well. Hargitt argues that the yolk is built up in the cytoplasm out of material which has come from the nucleus, or from the material in the cytoplasm through the aid of material which has come from the nucleus. His explanation is that perhaps an enzyme from the nucleus passes into the cytoplasm and there elaborates and synthesizes the food brought into the egg. Hargitt's observations on *C. flexuosa* show that the nucleolus fragments and entirely disappears. This great activity of the nucleolus coincides with the appearance of the deutoplasmic bodies. From this he concludes that the nucleolus is a dynamic centre concerned primarily with the nutritive activities of the egg-cell. Hargitt, however, does not assume that all the material which forms yolk bodies comes from the nucleus; on the contrary, he believes that a great amount of it comes into the cytoplasm from the food stream in the gastric cavity of the gonophore and never enters the nucleus.

Recent work on yolk formation in other groups of the Metazoa, particularly the Arthropoda and Mollusca, indicates the existence of two main types of yolk—true non-fatty yolk, and fatty yolk. At the present time the evidence as to the origin of the true yolk is not conclusive but points to the formation of this type either from the mitochondria or from the nucleolar extrusions. The fatty yolk apparently arises directly from the Golgi elements. In his account of the cytoplasmic inclusions of the egg of *Ciona intestinalis* Harvey (1927)[12] has attempted to show an intimate relation between the yolk of *Ciona* and the Golgi apparatus.

In the absence of specially fixed material of *Myriothela australis*, I am unable to offer any observations on the mode of formation of the yolk, and in the following notes merely record changes in the latter during and after its formation. The yolk first appears in the periphery of the cytoplasmic areas before the final absorption of all the primary oocytes has been completed. As the cytoplasmic areas begin to fuse into the formation of the plasmodial areas, the yolk rapidly increases in quantity and presents the most outstanding feature in these areas owing to its intensive staining reaction compared with that of the surrounding cytoplasm.

There are two main types of yolk in the egg of *M. australis*: (*a*) small simple yolk spheres which vary greatly in size and lie close to the periphery of the egg, and (*b*) compound yolk spheres which form the largest elements in the egg. These occur as a layer around the egg, a little below the surface, and are found to some extent throughout the centre of the egg.

The two kinds of yolk, simple and compound, show their distinctive characters when stained with Ehrlich's hæmatoxylin

[12] Harvey.—Proc. Roy. Soc., B, Vol. 101, 1927.

followed by eosin. These stains reveal, in certain of the spheres, drops or globules which stain more intensely than the ground-substance of the sphere. After the use of Ehrlich's stain the mature simple yolk is uniformly light red in colour while the compound spheres show very dark red globules in a dark red ground-substance.

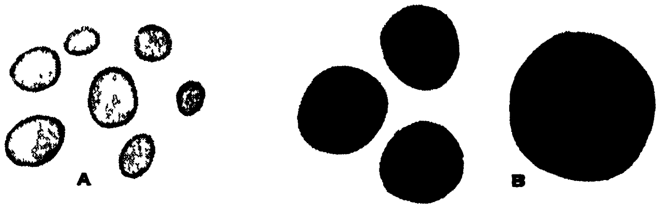


Figure 4.
Myriothela australis, Briggs. A. Simple yolk spheres. B. Compound yolk spheres.

The first elements to appear in the cytoplasm are small yolk spheres, about 3 μ in diameter, which develop into the simple yolk. When the cytoplasmic areas in the sub-umbrellar cavity of the gonophore begin to fuse together, some of the spheres grow more rapidly than the others, so that the uniformity in size is lost. A few now increase in size very rapidly, giving rise to yolk spheres of very unequal sizes. These measure from 6 μ to 9 μ in diameter.

The compound yolk spheres of the mature egg are probably derived from small yolk spheres similar, at first in appearance, to those which give rise to the simple yolk. As the compound spheres continue to grow, small internal globules appear which increase in size until they merge and practically fill the sphere. The size of these spheres varies considerably, some of them measuring 15 μ in diameter and forming the largest elements in the egg.

Although I am unable to determine the precise method of yolk formation, it seems evident that the two kinds of yolk, simple and compound, develop from the cytoplasm or its inclusions, and not from the Pseudozellen as stated by Labbé and Benoit. Whether the yolk spheres develop from pseudochromatin-granules, or from mitochondria, or directly from the cytoplasm itself I am, of course, unable to say, but the presence of simple yolk spheres in the gastric endoderm of the gonophore also suggests a probable source of nutritive material for the growing egg.

Summary.

1. The development of the male and female gonophores in *Myriothela australis*, Briggs is described and figured.

2. All the gonophores on a blastostyle are of the same sex, and throughout any one individual the sex of the gonophores is uniform.

The mature gonophores are spherical in form, supported on narrow cylindrical peduncles which spring without any definite arrangement from the sides of the blastostyles. The immature gonophores are borne on the proximal part of the blastostyle with the mature ones towards the distal extremity.

3. In the female there are usually three or four mature gonophores near the distal end and some six to eight immature ones on the proximal side of these. In the male the gonophores are more numerous though slightly smaller than those in the female, up to fifteen occurring on a single blastostyle.

4. The male gonophore appears as an endodermal evagination consisting of a mass of cells which penetrates deeply into the ectoderm. The *Glockenkern* increases in size and a split occurs in the cell-mass where a small cavity is formed. This enlarges into a spherical chamber which constitutes the *Anlage* of the sub-umbrellar cavity.

5. The outgrowth of the gastric endoderm gives rise to the manubrium. This forces back the cells on the floor of the sub-umbrellar cavity and the endoderm-lamellæ commence to separate in the axis of the gonophore. From the cells on the floor of the sub-umbrellar cavity are derived the male reproductive elements.

6. The first stage in spermatogenesis begins in the mass of cells covering the spadix and is accompanied by a rapid multiplication of the nuclei. Then the cytoplasm breaks up and comes to surround each nucleus, forming the spermatogonia in the central part of the mass. By division, the spermatogonia give rise to the primary spermatocytes. From these are derived the secondary spermatocytes which almost completely fill the sub-umbrellar cavity.

7. The definitive male gonophore has a diameter of 700 μ. At its distal pole the ectoderm becomes invaginated to form the velar aperture which breaks through into the sub-umbrellar cavity.

8. In the female gonophore the cells of the germinal mass are arranged in several layers; those in the outer layer form the external epithelium of the future spadix, while the others represent the mother-cells of the future reproductive elements and form the oogonia.

9. An evagination of the endoderm cells at the distal end of the gastric cavity forms the manubrium. The oogonia multiply and finally fill the entire space between the manubrium and the sub-umbrellar epithelium.

10. The oogonia multiply and increase in size to give rise to the primary oocytes which press closely against one another and assume a polygonal form.

11. The first appearance of egg-formation occurs among the primary oocytes situated in the lower layers of the cell-mass. Here two primary oocytes come into close contact and their cytoplasm fuses to form a small cytoplasmic area. The sub-umbrellar cavity gradually fills with a number of these cytoplasmic areas. These increase in size by accretion of either new primary oocytes, or of previously-formed cytoplasmic areas.

12. The final absorption of all the primary oocytes into the cytoplasmic areas is followed by the fusion of the areas themselves, forming some five or six large plasmodial areas completely separated by non-cellular partitions.

13. The definitive egg is produced by the withdrawal of the partitions and the subsequent fusion of the plasmodial areas. Its cytoplasm contains numerous basophilic granules. The Pseudozellen lie close to the periphery of the mature ovum where they have arisen from the slightly degenerate nuclei of the primary oocytes which were the last to fuse with the cytoplasmic areas. The cytoplasm becomes charged with yolk, which constitutes the deutoplasm of the egg.

14. The definitive female gonophore has a diameter of 800 μ. The whole of its interior is occupied by the large definitive egg which has driven the spadix completely back into the gastric cavity of the blastostyle. The distal pole of the gonophore is occupied by the velar aperture.

15. The presence of an apical aperture in both the male and female gonophores suggests that the ripe spermatozoa escape through the opening at the distal pole of the male gonophore and so reach the surrounding water. These sperms carried by the currents to the female gonophores are able to enter through the apical aperture and effect the fertilization of the mature ovum.

16. The history of the yolk is discussed and the suggestion made that the yolk is formed in *Myriothela australis* directly from the cytoplasm or its inclusions, and not from the Pseudozellen as stated by Labbé and Benoit.

17. There are two main types of yolk in the egg: (*a*) small simple yolk spheres which vary greatly in size, and (*b*) compound yolk spheres which form the largest elements in the egg.

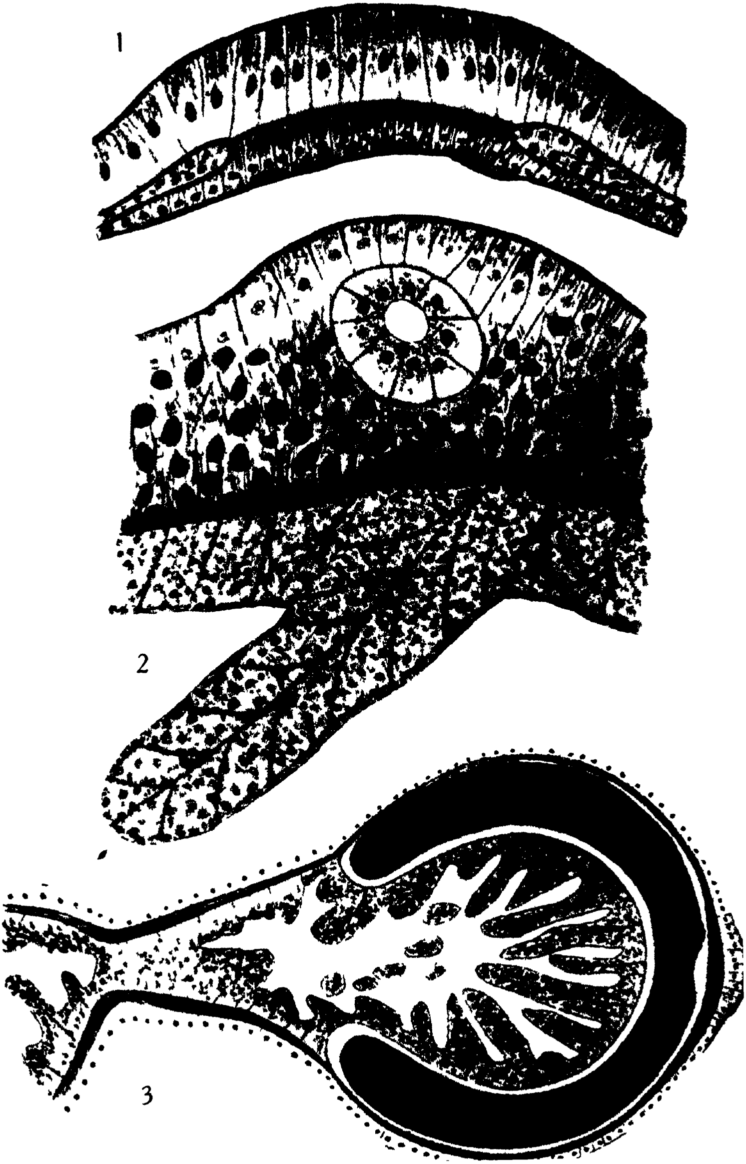
EXPLANATION OF PLATE XLII.

MYRIOTHELA AUSTRALIS, *Briggs.*

Fig. 1. Vertical section through the distal pole of a male gonophore. The ectoderm is composed of deep columnar cells lying directly above the gap between the endoderm-lamellæ. The cells of the sub-umbrellar epithelium have entered the gap between the endoderm-lamellæ and come into close contact with the ectoderm.

Fig. 2. An early stage in the development of the male gonophore, showing a mass of endoderm cells deeply imbedded in the ectoderm and cut off by the formation of a non-cellular layer. These endoderm cells are arranged in a single layer surrounding a spherical chamber which constitutes the *Anlage* of the sub-umbrellar cavity.

Fig. 3. Vertical section through a male gonophore showing its spherical form and narrow cylindrical peduncle by which it retains its connection with the blastostyle. The sub-umbrellar cavity is filled with a mass of primary spermatocytes.



E. A. Briggs del.

EXPLANATION OF PLATE XLIII.

MYRIOTHELA AUSTRALIS, *Briggs*.

Fig. 1. Vertical section through a young male gonophore in which the sub-umbrellar cavity has become flattened due to the outgrowth of the gastric endoderm to form the manubrium.

Fig. 2. Vertical section through an advanced stage of a male gonophore. At the distal pole, the raised patch of ectoderm cells has invaginated at the centre to form a small pit-like depression which eventually breaks through into the sub-umbrellar cavity. The velar aperture thus established is lined by a deep columnar epithelium. The sub-umbrellar cavity is filled with a large mass of secondary spermatocytes.

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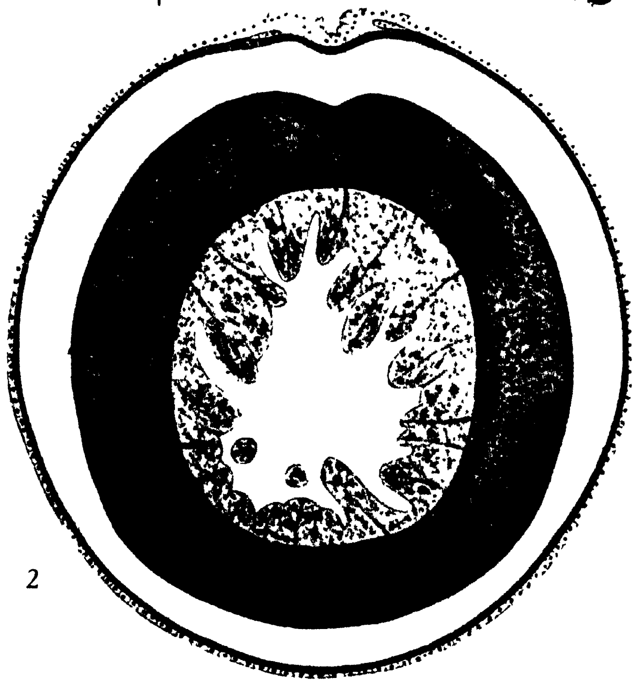

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EXPLANATION OF PLATE XLIV.

MYRIOTHELA AUSTRALIS, *Briggs*.

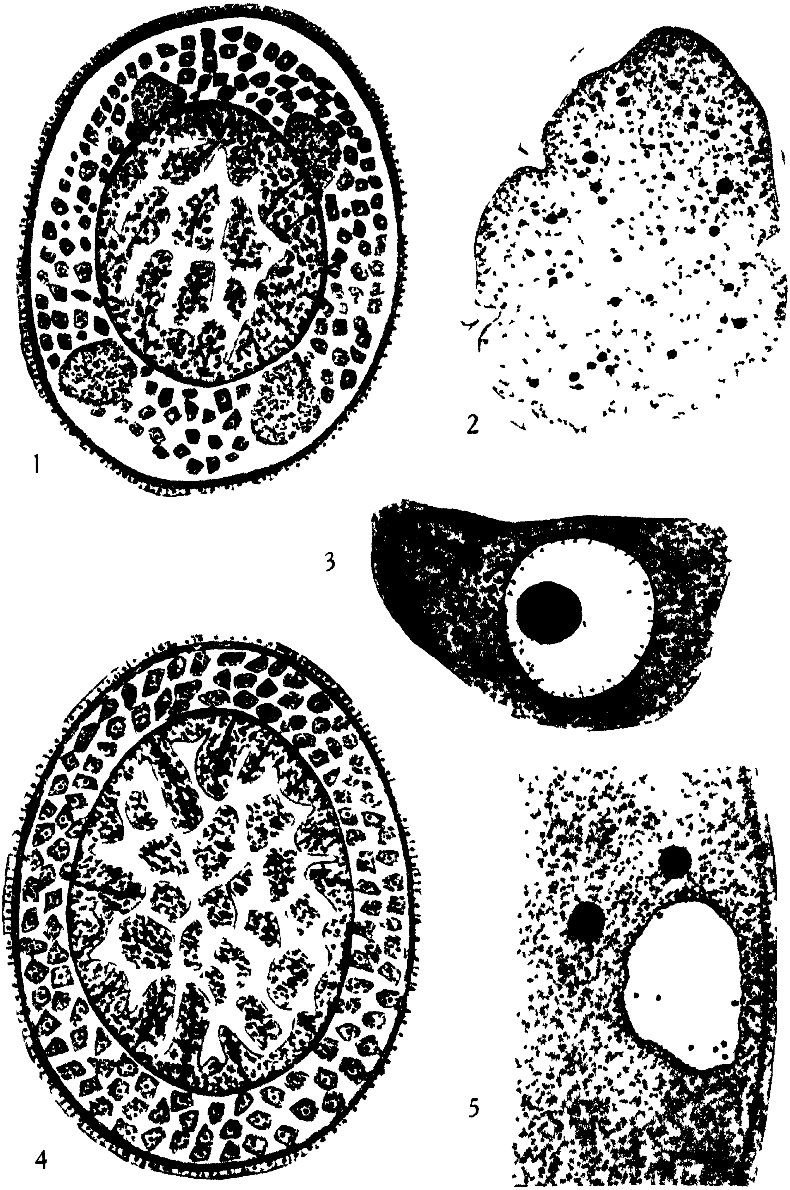
Fig. 1. Transverse section through a female gonophore showing the sub-umbrellar cavity filled with primary oocytes and four cytoplasmic areas.

Fig. 2. Tangential section through a definitive ovum. The withdrawal of the thin, non-cellular partitions is not yet complete; this is indicated by the indentations on the surface of the egg. The cytoplasm is heavily charged with yolk spheres. The outer wall of the gonophore has been omitted from the drawing.

Fig. 3. Primary oocyte from the sub-umbrellar cavity of a female gonophore.

Fig. 4. Transverse section through a female gonophore showing the sub-umbrellar cavity filled with primary oocytes.

Fig. 5. Section through the periphery of a cytoplasmic area. The nucleus is discernible as an oval body enclosed by a slightly wrinkled, deeply-staining, nuclear membrane. Two compound yolk spheres occur in the cytoplasm close to the nucleus.



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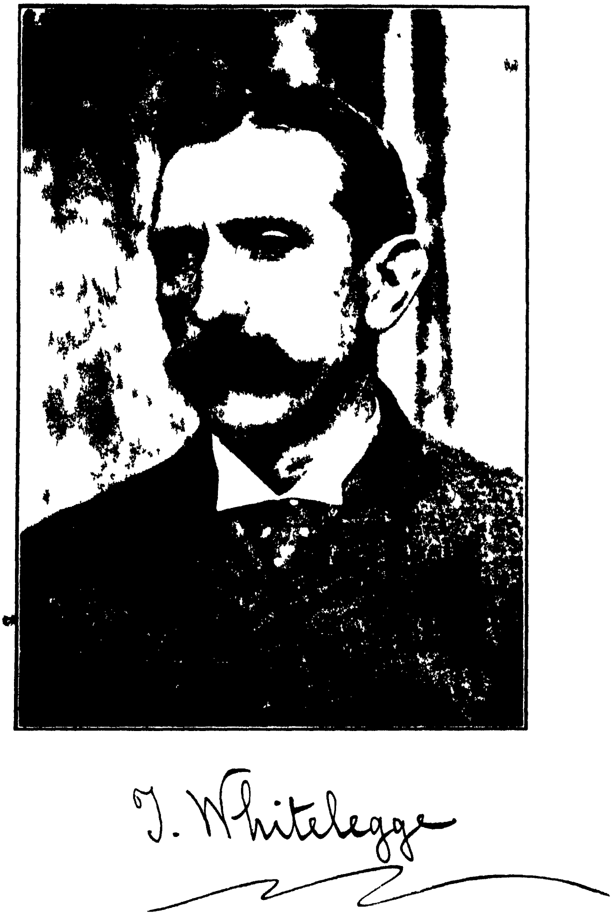

THOMAS WHITELEGGE, at the age of 45,
from a self taken portrait.

OBITUARY.

THOMAS WHITELEGGE, 1850-1927.

At Sydney on August 4, 1927, Thomas Whitelegge passed quietly from his circle of friends, after a life of intellectual attainment to which few have risen from such an obscure beginning. The death of this accomplished zoologist and able botanist removes one of our last links with the Australian systematists of last generation.

Whitelegge was born of humble parents at Stockport in Cheshire, England, on August 17, 1850. Soon after his birth the family was cast into destitute circumstances, and young Whitelegge received but meagre schooling, being put to work for one half of each week at the tender age of eight years. One year later his father died and his son's miserable pittance of two shillings and sixpence per week contributed to the support of his mother, who was a bobbin winder by occupation. From this time up to the age of about fifteen, Whitelegge suffered hardships and privations which might well have seared the soul of a less spirited and resourceful being. A review of his vicissitudes will read like romance in these modern days of comparative comfort and protection; it will show the greatness of the man and the merit of his ultimate accomplishment.

From his early service in a tarpaulin factory, young Whitelegge moved to the occupation of "piecer" in a cotton mill. Later he went to learn weaving in the service of a cousin, but one day he made the grave error of putting two shuttles in the loom at one time, and the warp was broken. This act led to dismissal and the lad then gained employment in a machine shop, where he was occupied with tapping nuts and putting threads on bolts. At the age of eleven he entered Christy's Hat Manufactory at Stockport, after undergoing medical examination and being certified as a youth of fourteen years. After gaining an insight into this trade, the youth signed indentures and became bound as an apprentice to another hat manufacturer for a term of seven years. The wages were six shillings a week for the first two years of this employment, and then an increase of two shillings per week until half of the apprenticeship term was served. After that Whitelegge was to be put on journeyman's rates, but was to receive only one third of these earnings. Just prior to this last employment he was receiving only four shillings per week, on which he and his mother subsisted during the awful days of the Lancashire cotton panic, brought about by the American Civil War. During the whole of one year the little family had no meat of their own buying, and in order to

replenish the larder young Whitelegge used to rise at daylight on Sundays to scour the countryside for blackberries and mushrooms, and occasionally seized potatoes and turnips from the properties of unsuspecting farmers. At this time his earnings provided the rental of a house at one shilling and sixpence per week, leaving a balance of two shillings and sixpence for food and clothing. It was pitiful to hear Whitelegge relate these facts, and to realize that the family would have been better off if he had been out of employment, as the relief money given at the time of the cotton panic amounted to two shillings and twopence per head. Having all this suffering still vivid in his memory, Whitelegge soon became acutely aware that the terms of his apprenticeship were iniquitous, and after some contemplation he deserted his master. Setting out on foot towards Ashton-under-Lyne in Lancashire, he reached the village of Hurstbrook near this town, and succeeded in getting work as a journeyman with a kindly hat manufacturer, to whom he confessed his trials. With his new employer's help, Whitelegge evaded police inquiry, and sheltered at a farmhouse some distance away, where all available work was taken him. Except that he was all but arrested on several occasions when surreptitiously visiting his mother at Stockport, his stay of two years on the farm was spoken of by Whitelegge as one of the most enjoyable periods of his life. Apart from his trade he did farm work and some carting around the district, but was able to rise early and had finished work in the early afternoon. This gave him ample time to ramble the countryside as was his bent, and so develop what later became a profound acquaintance with Nature, coupled with acute powers of perception. The passing of years brought peace and comparative comfort to Whitelegge, and he was able to ply his trade uninterruptedly at the Hurstbrook shop. It was in this adopted centre that he first happened upon the means of indulging his great interest in natural history. The first inspiration came from reading accounts of the Manchester Science Lectures. One lecture on coal by Professor W. Boyd Dawkins caused Whitelegge to seek books on geology, and he studiously read on this subject for two years. Meantime he made an excellent collection of fossils from the rich coal measures of the district, and in seeking more knowledge soon came in contact with those societies of artisan naturalists which made Lancashire famous during last century. These organizations, in which Whitelegge rose to such eminence by assiduous self-culture before he left the Old Country, were supported mainly by men who never rose beyond comparative poverty and obscurity, their humble life preventing them from attaining to that rank and estimation among the naturalists of the age to which many were so eminently entitled. Whitelegge first joined the Ashton Linnæan Botanical Society (in 1874), for there were several among its members interested in geology. Soon, however, he took up the study of botany, which was the prominent subject among the men with whom he was

now associating. One, Edwin Clough, became his tutor and field companion, and he successfully attended a course of advanced study under Mr. J. R. Byrom of Oldham and Mr. H. Hyde of Manchester. Soon Whitelegge gained a reputation for knowledge in the surrounding districts, and attained high office in several societies. The formation of an herbarium resulted from his week-end rambles, and this afterwards numbered 1,000 species. Later developing an interest in microscopic pond life, he founded the Ashton Biological Society and gained a reputation as a specialist in this branch of natural science. Several of his faunal lists were published in the *Ashton Evening Reporter* and the *Manchester Guardian*. Also in the pages of these newspapers appeared full notice of the meetings and other activities of the various bodies to which Whitelegge belonged. Application and industry eventually secured for him a post as teacher of an evening course in botany at the Albion Schools, Ashton-under-Lyne, under the Science and Art Department. While studying the cross-fertilization of flowers in 1878 Whitelegge made several interesting observations and communicated them to Charles Darwin. The kindly advice and help of this great naturalist encouraged Whitelegge to a discovery of gynodiœcious flowers on single plants in two species of buttercups (*Ranunculus*). With reference to this discovery Darwin wrote:

Down, Beckenham, Kent,
May 12, 1878.

DEAR SIR: I am much obliged for your letter I am certain that I have never met with any account of any species of *Ranunculus* being gynodiœcious, but I have seen it stated that they tend to be diœcious, perhaps in consequence of such plants as you have been so good as to send me. Should I print a new edition of my last book I will introduce on your authority this case.

Dear Sir, yours faithfully,
(*Signed*) CHAS. DARWIN.

Later Whitelegge found *Stachys germanica* with the same kind of flowers as above, and, following a further letter to Darwin, he received a reply:

Down, Beckenham, Kent,
July 16, 1878.

DEAR SIR: It is very kind of you to take so much trouble, but I beg you not to take any more, as I do not think it likely that there will be a new edition of my "Forms of Flowers," and unless there be one I shall not be able to use all the information which you have been so good as to send me. The *Stachys* seems a very fine case of what I have called gynodiœciousness. Your activity and powers of observation seem very great.

Dear Sir, yours faithfully,
(*Signed*) CHAS. DARWIN.

Whitelegge had married some years after, removing to Ashton-under-Lyne, and after the death of his mother he developed a keen desire to migrate to Australia with his wife and child. Fascinating

accounts of the opportunities in the new land and its wonderful unstudied flora continued to interest him, and on October 16, 1882, he left from Plymouth on the sailing ship *Uterpe* to try his lot in the land of his adoption.

It was fitting that he be farewelled by members of the Society of which he was founder. Thus it was at the annual meeting of the Ashton Biological Society that the president, Mr. J. R. Byrom, presented Whitelegge with an illuminated address and a purse of gold subscribed by members of the Society and other local bodies. The address read as follows:

TO MR. THOMAS WHITELEGGE.

DEAR SIR: On the occasion of your leaving your native land for Australia, the members of the Societies hereinafter named could not permit your departure without placing on record their appreciation of your patient, persevering and eminently successful labours in the various fields of biological research. You have taken a leading part in investigating Botany, Geology, and more especially the micro-pond life of the surrounding district. Your contributions to the fauna and flora of the Ashton district will ever remain a monument of your indefatigable industry. Your enthusiasm in science has won the admiration of all your co-workers in the same pursuit; and your unassuming and genial disposition, joined to an unvarying readiness to assist has endeared you to us all. You carry with you our best wishes for your future welfare and success in life. We also trust that in new fields of labour which will be opened out to you, you may be as successful as a teacher and student of Nature as you have been at home.

Signed, on behalf of the
Ashton Biological Society,
J. R. BYROM, President.
J. S. ROWSE, Secretary.

Ashton Linnæan Botanical Society,
JOHN WHITEHEAD, President.
HENRY SEARLE, Secretary.

Ashton Field Naturalists' Society,
CHAS. WALDEN, President.
A. NEWTON, Secretary.

Oldham Microscopical Society,
J. ASHTON, President.
CHAS. WALTERS, Secretary.

Stalybridge Microscopical Society,
R. HOPWOOD, M.D., President.
W. H. HIRST, Secretary.

Mechanics' Institute, Ashton-under-Lyne,
7 October, 1882.

Another glowing account which appeared in the *Ashton Reporter* in October, 1882, was from the pen of Mr. A. Park of the Albion Schools, Ashton-under-Lyne. Portion of it read:

Mr. Whitelegge sustained to me—for several years, owing to his being a member of the teaching staff of our Science Course at the Albion School—a very close and intimate connection, and I wished to say that nothing

surprised me more than the readiness of resource—the facility and simplicity of illustration—the quiet yet forceful energy which he brought to bear on his instruction to the student under his care.

I have not the smallest doubt that he is destined yet to add immensely, by his original investigations, to the knowledge we now possess of many departments of Natural Science.

After an eventful voyage of nearly four months Whitelegge landed in Sydney with his family on 10th February, 1883, and took up his residence at North Sydney. He had in his possession some excellent letters of introduction, and testimonials from such prominent scientists as Sir Joseph Hooker of Kew Gardens, Professors W. C. Williamson and Milne Marshall of Victoria University, Manchester, and Professor Marcus Hartog of Queen's College, County Cork, Ireland. For several months these proved of no service, and Whitelegge was forced to take up labouring work with a plasterer. During this hard period he sought solace in the evenings examining under the microscope at an open street window the many strange creatures he had collected in the pools of the surrounding district. Residents commented interestedly on this habit, so that Whitelegge soon came under the notice of a brewer named Kingdon living in the district, who hailed him as a fellow microscopist. This romantic meeting resulted in Whitelegge's acceptance of an offer of employment at the old Orient Brewery in Bourke Street, Redfern. Here Whitelegge spent six months in more or less congenial surroundings, for when he was not busily engaged with his labouring task he mounted and prepared micro-organisms and plants collected in the adjacent swamps. One day the late Rev. J. E. Tenison-Woods called on the brewer and during a conversation remarked on the similarity of certain of the local aquatic plants to those he was familiar with in England. Mr. Kingdon kindly introduced Whitelegge into the discussion and he surprised Tenison-Woods with the accurate knowledge he possessed of the various plants and their names. At that time Tenison-Woods was president of the Linnean Society of New South Wales, and induced Whitelegge to attend the next meeting of that body in company with his employer for the purpose of exhibiting before the members samples of the plants under discussion. Thus he became introduced to the Society, on the Council of which he afterwards served. It was Sir William Macleay, the founder of the Society, who proposed Whitelegge as a member, and his election took place on 30th May, 1883. In the same year he became a member of the Royal Society of New South Wales. With his entry into this sphere of scientific activity, Whitelegge's accomplishments soon gained their long deserved recognition. He regularly associated himself with the band of enthusiasts who attended the now historical week-end gatherings of the Linnean Society in Sir William Macleay's home at Elizabeth Bay in Sydney, and through the kind offices of the Rev. Tenison-Woods was brought under the

notice of Dr. E. P. Ramsay, Curator of the Australian Museum. A minor temporary appointment was secured for Whitelegge in that institution on 27th August, 1883. After a service of six months his ability was noticed by Dr. J. C. Cox, President of the Board of Trustees, who selected him to investigate the oyster pests of New South Wales on behalf of the State Fisheries. The results of this important work were published by the Australian Museum. As a mark of esteem for the valuable service rendered, the Parkes Govern ment voted Whitelegge a bonus of thirty five pounds. This and other zealous work earned him a permanent appointment on the staff of the Australian Museum in July, 1887, as a senior scientific assistant in charge of the Department of Lower Invertebrates. It is noteworthy that Whitelegge had earlier declined a position as demonstrator under Professor W. A. Haswell in the School of Zoology, Sydney University, and later an appointment under Dr. N. A. Cobb to the scientific staff of the Department of Agriculture Always he had in mind the establishment of the proposed Marine Biological Station on Green Point, Watson's Bay, and was closely associated with the Russian scientist, M. de Miklouho Maclay, who took an active interest in the project. Unfortunately, strained relations between Britain and Russia caused the project to be abandoned, and Whitelegge's fond hope of a congenial appointment was never realized. For some time about this period of Whitelegge's career he was lecturer in botany at the Sydney School of Arts and the Sydney Technical College.

Whitelegge's retiring nature and family responsibilities caused him to decline many offers of extended trips such as the Royal Society's Expedition to Funafuti, Ellice Islands, in 1897, and the trawling expedition of the H.M.C.S. *Thetis* off the coast of New South Wales in 1898. He did, however, visit Lord Howe Island in the south Pacific with an Australian Museum expedition headed by the late Director, R. Etheridge, jun., and the scientific results afterwards appeared in one of the institution's "Memoirs." The year 1899 saw Whitelegge appointed a Fellow of the Royal Micro scopical Society.

As a collector he was indefatigable, and possessed a most intimate and enviable knowledge of both the local marine and fresh-water faunas. His interest in the latter brought about a close correspondence with the noted G. O. Sars of Norway, which continued until his demise. Whitelegge habitually sent this great naturalist samples of mud collected from the swamps and pools he explored, and from these the micro-organisms were later bred out in Norway. As a botanist he made numerous excursions into the Blue Mountain Ranges, adding to his wide knowledge of the flora, particularly the cryptogamic. This last Whitelegge termed his recreation, and he spent much of his private time classifying and mounting mosses for inclusion in his large herbarium. A joint

paper with the Rev. W. W. Watts—"A Classified Catalogue of the Frondose Mosses of Australia"—was the outcome of his interest in cryptogamic botany. Another botanical paper of lasting quality was "The Gametophyte of *Psilotum*," published in the *Proceedings of the Linnean Society of New South Wales*.

Whitelegge's greatest zoological achievement was his "List of the Marine and Fresh-water Invertebrate Fauna of Port Jackson and Neighbourhood," which has been referred to as "the marine zoologists' bible." This was published in 1889, and earned for its author the distinction of a special gold medal and prize presented by the Royal Society of New South Wales. Other special zoological papers included reports on the Crustacea, Echinodermata, Alcyonaria, Porifera, Madreporaria, Hydrozoa, and Vermes collected by the Royal Society's Expedition to Funafuti. Numerous species in botanical and zoological literature have been named after Whitelegge, thus serving as a lasting tribute to his zeal as a collector.

Right up to the date of his death Whitelegge retained that unquenchable enthusiasm for science which marked his earlier career. It had even survived a trying period of his early middle age when he suffered the loss of his wife, and was left with five children to care for, the youngest only two hours old. Always of a most unassuming and modest bearing, he will be remembered by his intimates for the quiet energy and accuracy which he brought to the execution of his work. Latterly, he constantly associated with the staff of his old institution, The Australian Museum, frequently accompanying parties doing field work. In addition he retained a small post in the National Herbarium at the Botanic Gardens, Sydney, where he was the authority on mosses and ferns.

Whitelegge's life was one of persistent endeavour and successful achievement, and his work in diverse branches of natural history bears witness to his untiring industry and broad sympathies. His colleagues cherish his memory as an unassuming, kind-hearted and sincere friend, ever generous in helping others, and ever ready to give others the benefit of his wide knowledge of zoology and botany.

Two daughters and a son survive him.

FRANK A. MCNEILL.

CONTRIBUTION TO A BIBLIOGRAPHY OF THOMAS WHITELEGGE.

(BY GILBERT P. WHITLEY.)

This bibliography is not presumed to be complete, since I have no means of tracing the earlier writings of Whitelegge which may have been published in the natural history journals of the northern and midland counties of England. Whenever known, the exact date of publication of each paper is given. The titles are arranged in chronological sequence; papers of joint authorship are placed alphabetically under the second author's name, then in order of publication.

1882.

1. Wax Cells. *North. Microscopist* ii, 1882, p. 194 (*fide Journ. Roy. Micros. Soc.* (2) ii, 1882, p. 578).

1883.

2. Exhibition of living specimens of *Plumatella repens* from the Botany Swamps; and of dried specimens of *Nitella gelatinosa* from Randwick. *Abstr. Proc. Linn. Soc. N. S. Wales*, May 30, 1883, p. iii; *Proc. Linn. Soc. N. S. Wales*, viii, 2, July 17, 1883, p. 281.
3. Exhibition of specimens of *Plumatella repens* and of a Fresh-water Sponge, both from Moore Park, Sydney. *Abstr. Proc. Linn. Soc. N. S. Wales*, June 27, 1883, p. ii; *Proc. Linn. Soc. N. S. Wales*, viii, 2, July 17, 1883, p. 297.
4. Exhibition of a specimen of *Fredericella* (apparently *F. sultana* Blum.) not previously noticed in N.S.W. *Abstr. Proc. Linn. Soc. N. S. Wales*, Sept. 26, 1883, p. iii; *Proc. Linn. Soc. N. S. Wales*, viii, 3, Oct. 19, 1883, p. 416.
5. Exhibition of a new *Plumatella*-like organism from Moore Park. *Abstr. Proc. Linn. Soc. N. S. Wales*, Nov. 28, 1883, p. iv; *Proc. Linn. Soc. N. S. Wales*, viii, 4, Feb. 21, 1884, p. 465.

1884.

6. Exhibition of slides of Fossil Plants. *Abstr. Proc. Linn. Soc. N. S. Wales*, Feb. 27, 1884, p. iii; *Proc. Linn. Soc. N. S. Wales*, ix, 1, May 23, 1884, p. 178.

1885.

7. Exhibition of slides of Fossil Ferns from the Hawkesbury and Wianamatta formations. *Abstr. Proc. Linn. Soc. N. S. Wales*, Jan. 28, 1885, p. vi; *Proc. Linn. Soc. N. S. Wales*, x, 1, June 4, 1885, p. 62.
8. Exhibition of a collection of Australian Mosses. *Abstr. Proc. Linn. Soc. N. S. Wales*, May 27, 1885, p. vii; *Proc. Linn. Soc. N. S. Wales*, x, 2, July 31, 1885, p. 248.
9. Exhibition of, and Remarks on, Water Insects (*Notonecta*) with small Molluscs attached to their legs; also of Fresh-water Polyzoa killed with extended tentacles. *Abstr. Proc. Linn. Soc. N. S. Wales*, Nov. 25, 1885, p. vi; *Proc. Linn. Soc. N. S. Wales*, x, 4, April 3, 1886, p. 760.
10. Exhibition of specimens of a Fresh-water Hydroid Zoophyte (*Cordylophora*) from Parramatta. *Abstr. Proc. Linn. Soc. N. S. Wales*, Dec. 30, 1885, p. iv; *Proc. Linn. Soc. N. S. Wales*, x, 4, April 3, 1886, p. 854.

1886.

11. Exhibition of *Amœba radiosa*, *A. verrucosa*, and *Clathrulina elegans*. *Abstr. Proc. Linn. Soc. N. S. Wales*, May 26, 1886, p. iv.
12. Exhibition of *Ceratella fusca* from Bondi. *Abstr. Proc. Linn. Soc. N. S. Wales*, June 30, 1886, p. vii.
13. Exhibition of microscopic forms from Moore Park. *Abstr. Proc. Linn. Soc. N. S. Wales*, July 28, 1886, p. vii.
14. Exhibition of *Nitella*, with a note. *Abstr. Proc. Linn. Soc. N. S. Wales*, April 28, 1886, p. iii; *Proc. Linn. Soc. N. S. Wales* (2) i, Aug. 23, 1886, p. 476; *Nature*, xxxiv, July 22, 1886, pp. 283-284.
15. List of the Fresh-water Rhizopoda of N. S. Wales. Part i. *Proc. Linn. Soc. N. S. Wales* (2) i, Aug. 23, 1886, pp. 497-504.

16. **Exhibition of Infusoria and Rotifers from Waterloo Swamps.** *Abstr. Proc. Linn. Soc. N. S. Wales*, Aug. 25, 1886, p. v.

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1889.

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1890.

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1891.

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1898.

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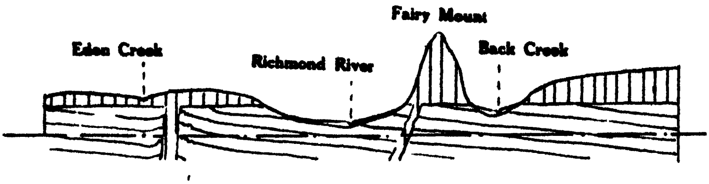

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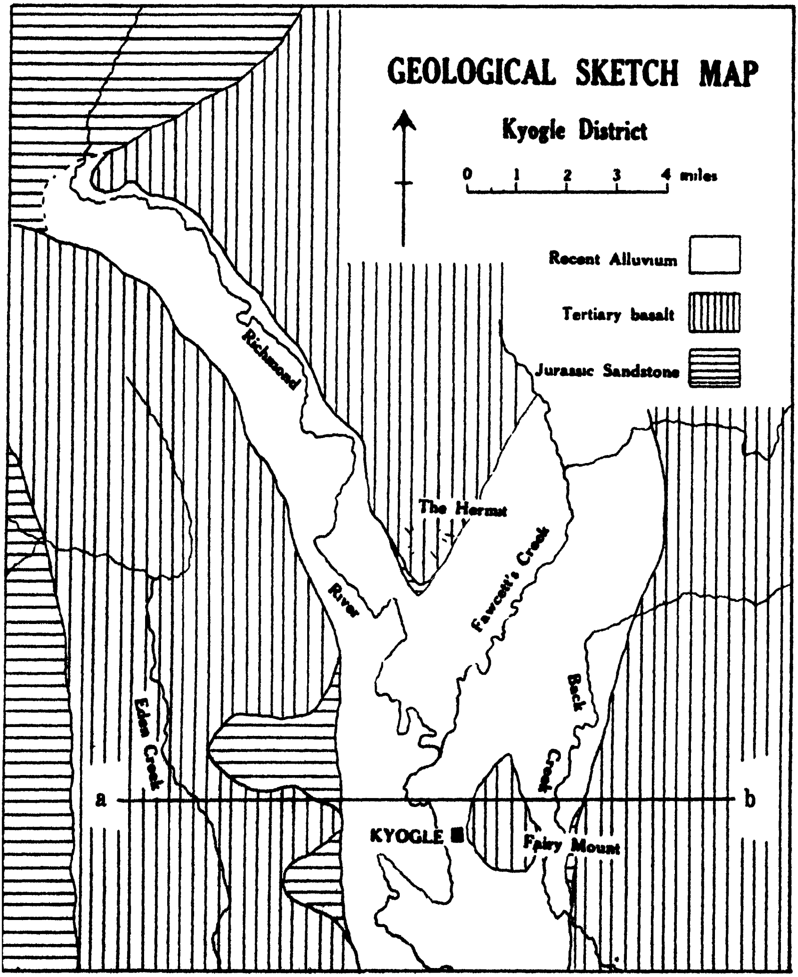

THE OCCURRENCE OF ZEOLITES AT KYOGLE, NEW SOUTH WALES.

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(Plate xlvi; Figures 1-5, and Map.)

The Kyogle Shire Council opened up a basalt quarry for the supply of road metal some years ago, but it was not until Dr. W. G. Woolnough visited the district in 1923 that it was known that this quarry was a prolific producer of zeolites and calcite. On his report the writer, accompanied by Mr. C. M. G. Friend, visited the quarry with a view to collecting and examining the occurrence. The visit was made possible by the generosity of Mr. Anthony Hordern, and over four hundred specimens, mainly chabazite, were obtained. The collection contains the finest specimens of this mineral yet obtained in Australia.

Kyogle is only 198 feet above sea level and is built on the fertile valley of the Richmond River, which has here reached a mature age. To the west of Kyogle the sandstone of Jurassic age dips under the alluvium and the basalt of Fairy Mount immediately to the east of the town. The dip of the sandstone here is 8° south-east, but, following the sandstone to the west, where it has been exposed by the denudation of the basalt (see map), the dip increases to about 15° south-east, and near its junction with the basalt to the west it shows distinct evidence of crumpling, indicating proximity to the fissure or vent from which the basalt was extruded. Fairy Mount is a residual of this basalt, and has been separated from it on the west and north by the valleys of the Richmond River and Fawcett's Creek respectively, while to the east it has been separated from the same mass of basalt by the valley of Back Creek.

The quarry face at the foot of Fairy Mount, and about thirty chains east of the Kyogle post office, discloses the fact that this mass of basalt is a complex structure. Four distinct flows can be readily recognized, as well as the presence of a dyke. The quarry face at the time was eighty feet high, and the greatest thickness of any one flow was thirty-six feet. Unfortunately the mountain is well covered with soil, and outcrops are scarce, but at a height of 900 feet vesicular basalt was observed to be overlain by solid basalt, indicating the surface of another flow. There is a marked absence

of pyroclastic rocks, suggesting that the effusion of basalt, though intermittent, was not of the explosive type, but rather in the nature of a fissure eruption. It is suggested from a study in the field that these fissures trended approximately north and south.

The basalt is typically of a very dark grey colour, and varies considerably in texture from porphyritic to even-grained. The phenocrysts consist of labradorite, and they appear to become more pronounced as one travels north from Kyogle. The basalt is generally rich in olivine. Under the microscope the basalt from the four flows at the quarry shows a very similar mineral content and fabric. The predominant mineral is labradorite, which is lath-shaped and gives distinct evidence of flow structure. Augite, which is the titaniferous variety with weak pleochroism, occurs as an interstitial mineral between the felspar laths. It is often altered to a green fibrous mineral with the fibres always at right angles to the periphery of the section. Olivine forms phenocrysts, and is sometimes very little altered. In a number of cases alteration takes place to iddingsite and a green serpentine-like mineral. Iron oxide and titaniferous iron are fairly abundant.

The basalt is obviously post-Jurassic in age. Prof. H. C. Richards[1] divides the tertiary volcanic rocks of south-eastern Queensland into Upper, Middle, and Lower Series. His description of the Upper Series might well have been taken from the Kyogle occurrence, and there can be no doubt that the Kyogle basalt is the equivalent of his Upper Series. He places the age of this division as Upper Cainozoic, and compares them to the Ben Lomond basalt, which Professor Sir T. W. Edgeworth David[2] places as probably Pliocene. These two basalts are very similar in appearance under the microscope, and it is of interest to note that both are characterized by the presence of abundant chabazite occurring in the vesicles and crevices of the rock.

For the sake of convenience, the flows exposed at the quarry have been numbered from one to four. No. 1 flow is partly exposed at the floor of the quarry, and No. 4 is the topmost flow to be seen at the time of our visit. At about the centre of the quarry the surface of No. 2 flow forms a small, rather broad, V-shaped depression, which is partly filled with irregular blocks and fragments of basalt which has been completely altered. The felspar is invariably zeolitized. The augite and olivine have been entirely replaced by a green fibrous chloritic material, zeolites, and calcite. Large cavities exist between these blocks of altered basalt, and they are nearly always lined with zeolites and calcite. Indeed, it was from here that most of the specimens were collected.

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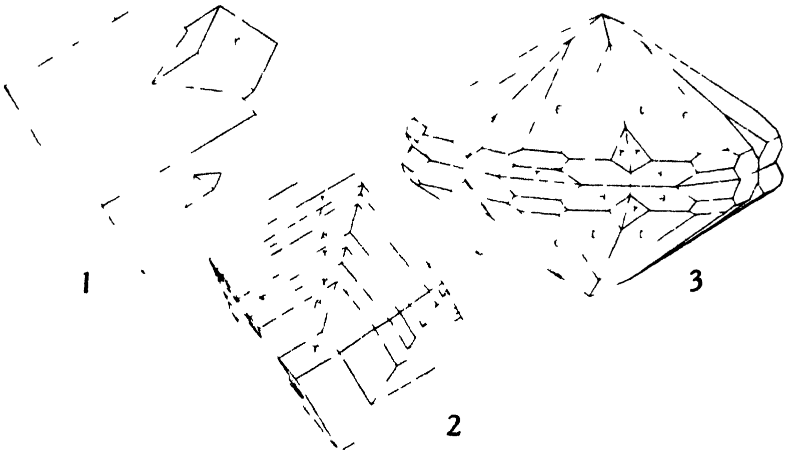
[1] Richards.—Proc. Roy. Soc. Q'land, xxvii, 7, 1916, pp 117-118
[2] David.—B.A.A.S., 1914, N.S.W. Handbk., p. 608A.

CHABAZITE.

(Figures 1-3.)

No chabazite was found in No. 1 flow, but in the vesicles of No. 2 flow a number of simple rhombohedrons occur (Fig. 1). These are generally quite small, seldom measuring more than 2 mm. in diameter, and often twinned on the $\acute{c}$ axis. The faces are invariably striated and curved, giving not very satisfactory measurements; they belong to the form *r* (10$\bar{1}$1). In one specimen (Fig. 2) the rhombohedrons were relatively large, measuring 15 mm. along the edge. These were modified by the scalenohedron β (13·10·$\bar{23}$·13). Most of the chabazite was obtained from the breccia between No.



Figures 1–3

Chabazite from Kyogle, New South Wales Fig 1 · Simple rhombohedron twinned on the vertical axis. Form · *r* (10$\bar{1}$1) Fig. 2 Modified rhombohedrons. Forms: *r* (10$\bar{1}$1), β (21·2·$\bar{23}$·25) Fig 3. The phacolite type Forms: *r* (10$\bar{1}$1), *a* (11$\bar{2}$0), *t* (11$\bar{2}$3), *c* (01$\bar{1}$2), *s* (02$\bar{2}$1).

2 and No. 3 flows. Wherever a cavity was broken open it was found to contain alkaline water, and the moist chabazite was quite colourless in almost every case. On exposure to the atmosphere the chabazite became milky to almost opaque white. The temperature at the quarry during the early afternoon was never less than 100° F. On being immersed in water the chabazite regained its transparency. This property of chabazite was noted by D. A. Porter[3] in his description of the mineral from Ben Lomond, New South Wales.

The chabazite is mostly of the phacolite type (Fig. 3), and is very similar in habit to that found at Ben Lomond, figured by

[3] Porter—Journ Roy. Soc N S W, xxii, 1, 1888, p 88

Dr. C. Anderson.[4] Unlike the phacolite (seebachite) from Richmond, Victoria,[5] the basal plane was not found on any of the numerous crystals examined. The majority of crystals were so modified as to be lenticular in shape, due to the fact that the individual parts of the twin are made up of a number of units in parallel growth.

Only a very few specimens were obtained from No. 3 and No. 4 flows. The crystals were of the phacolite type, but were not well developed.

Four crystals of the phacolite type and two of the rhombohedral type were selected for measurement, and the mean ϕ and ρ angles as measured, together with the calculated angles are given in Table I. The measurements cannot be considered as very satisfactory, as centering was a somewhat difficult matter, and, at best, could only be considered fair. The form *a* $(11\bar{2}0)$ is always a bright face, but consists of four parts which are striated parallel to their intersection with *r*, and in consequence gave multiple signals. The faces of *t* $(11\bar{2}3)$ are invariably striated parallel to the edge *e/t*, and more often than not *e* and *t* alternate. The form *s* $(02\bar{2}1)$ usually has bright faces, though these are very small. No crystals were found which could be determined as belonging either to the gmelinite or levynite types.

TABLE I.—CHABAZITE, KYOGLE, NEW SOUTH WALES.

Forms.		Measured.		Calculated.		Error.	
Goldschmidt.	Dana.	φ	ρ	φ	ρ	φ	ρ
		° ′	° ′	° ′	° ′	′	′
r $(11\bar{2}1)$	*r* $(10\bar{1}1)$	29 58	51 18	30 00	51 25	02	07
b $(10\bar{1}0)$	*a* $(11\bar{2}0)$	00 10	90 00	—	90 00	10	—
t $(10\bar{1}1)$	*t* $(11\bar{2}3)$	00 11	36 36	—	35 54	11	18
e $(\bar{1}\bar{1}22)$	*e* $(01\bar{1}2)$	29 42	31 42	30 00	32 05	18	23
s $(\bar{2}\bar{2}41)$	*s* $(02\bar{2}1)$	29 52	68 10	30 00	68 15	08	05
β $(13{\cdot}10{\cdot}\overline{23}{\cdot}13)$	$(21{\cdot}2{\cdot}\overline{23}{\cdot}25)$	25 44	47 44	25 41	48 03	03	19

The result of a chemical analysis is given in Table II, and is compared with that of the Ben Lomond chabazite. It will be noticed that the Kyogle mineral is richer in alkalies and correspondingly lower in lime. The specific gravity is 2·099.

[4] Anderson.—Rec. Austr. Mus., vi, 6, 1907, pp. 416-418, pl. lxxix.
[5] Rath.—Monatsber, d. k. preuss. Akad. Wiss., Berlin, 1875 (1876), pp. 523-532.

TABLE II.—CHEMICAL ANALYSIS OF CHABAZITE.

	Kyogle.	Ben Lomond.*
SiO_2	46·89	47·37
Al_2O_3	19·96	19·16
CaO	7·64	9·52
Na_2O	3·92	1·11
K_2O	0·18	0·93
H_2O-	} 22·05	3·43
H_2O+		18·41
	100·64	99·93

CALCITE.
(Figures 4-5.)

Calcite occurs in three distinct varieties, as follows:—

1. Large pale amber-coloured scalenohedrons capped by a basal plane and invariably coated with chabazite (Plate xlvi).

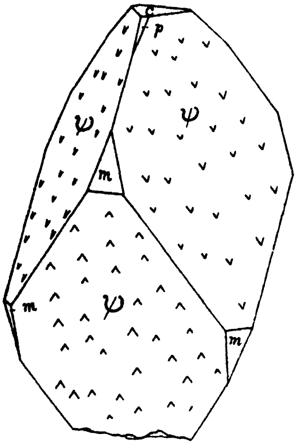
2. Small colourless crystals, occurring in the small vesicles of the basalt (Fig. 5).

3. Small amber-coloured rhombohedrons deposited on chabazite (Fig. 4).

1. The large scalenohedrons invariably exhibit well marked zonal growth. As many as eight different layers have been deposited on the original crystal; each layer can be removed with ease. Incidentally, this, together with the perfect cleavage, made the collecting of these crystals a very difficult matter. No definite scalenohedron is represented, as there is an oscillation between several scalenohedrons and the unit rhombohedron. This oscillation becomes more pronounced as each additional layer is deposited. Several crystals were broken up, the original crystal mounted on a two-circle goniometer, and centered by means of the cleavage planes. Readings on the scalenohedrons were quite unsatisfactory and variations of as much as 4° were noted. They are positive forms, and, comparing them with those of the second type of crystal, which is similar though smaller and has a greater development of forms, the principal scalenohedron appears to be X: $(19{\cdot}1{\cdot}\overline{20}{\cdot}1)$. In one of the core crystals rather better signals were obtained, giving measured ϕ and ρ angles of 4° 15′ and 81° 41′, which correspond to an unrecorded form with very large indices $(119{\cdot}11{\cdot}\overline{130}{\cdot}10)$, which has calculated ϕ and ρ angles of 4° 22′ and 82° 00′. There is no definite plane of attachment of the crystals, which may lie horizontally or project from the surface at any angle. Two fairly large crystals coated with chabazite were

* Anderson.—*Loc. cit.*

doubly terminated. Measurements taken of the thickness of the various zones of growth on twelve crystals, chosen at random from the collection, present some interesting features (Table III).



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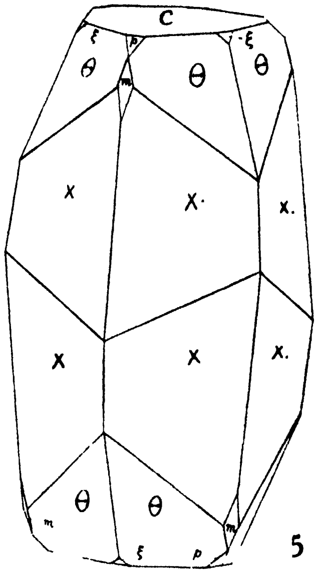

5

Figures 4–5.
Calcite from Kyogle, New South Wales. Forms: $p\cdot$ $(11\bar{2}1)$, $m\cdot$ $(44\bar{8}1)$, $\xi\cdot$ $(\bar{4}\bar{4}83)$, Θ $(\bar{4}\bar{1}51)$, $\psi\cdot$ $(5\cdot\bar{5}\cdot10\cdot2)$, X : $(19\cdot1\cdot\overline{20}\cdot1)$.

There is a remarkable agreement between the thickness of any one zone as compared to that of the same zone in any two crystals. Referring to the last column of the table, which gives the average

TABLE III.—MEASUREMENTS (MM.) OF THE ZONES OF GROWTH OF CALCITE, KYOGLE, NEW SOUTH WALES.

Zone.	Crystal.												Average.	Ratio.
	1	2	3	4	5	6	7	8	9	10	11	12		
Outer	3	3	3	2	3	3	2·5	2·5	2·5	3	2	3	2·7	1
2	4·5	3·5	3	2·5	4	3	3	3	3	3·5	3	4	3·3	1·2
3	7	6	5	5	7	5	5	5	5	5·5	5·5	6	5·6	2·1
4	7	7	6·5	6	—	6	6	5	4·5	7	5·5	6·5	6	2·2
5	3·5	4·5	4	3·5	—	4	3	3	—	4	4	5	3·9	1·4
6	4	—	3·5	3·5	—	4	3	3	—	—	3·5	—	3·5	1·3
7	10	—	9	9	—	—	—	9	—	—	8	—	9	3·3
8	—	—	10·5	—	—	—	—	—	—	—	12	—	11·2	4·1

relative thickness of the various zones, assuming the outer zone to be unity, it will be seen that the zones are arranged in pairs. The outside two zones have an average relative thickness of 1 and 1·2, the next two are approximately twice as thick, while zones 5 and 6 are somewhat narrower, and the last pair are much thicker, being 3·3 and 4·1, showing a greater discrepancy than do the others. With the exception of zones 5 and 6 there is a gradual diminution of thickness from the centre outwards. In every case the outer zone is coated with chabazite. It is to be noted that, although there is this remarkable relation in the thickness of the various zones, all crystals do not possess the same number of zones. The greatest variation exists between crystal 5, with only three zones, and crystals 3 and 11, with the full complement of eight zones.

The maximum measurements made on these crystals were, length 27 cms. and diameter 11 cms.

These crystals were confined entirely to the breccia area.

2. The small colourless crystals were obtained mainly in small vesicles, either alone or with analcite. In one case a crystal of this type was found deposited on chabazite. They were not confined to any one flow, but were found in all flows, though they existed more plentifully in No. 2 flow. They were never found in the brecciated area.

Five of these crystals were measured on a two-circle goniometer, and the measured ϕ and ρ angles, together with the calculated angles, are given in Table IV. The only forms to give really good signals were the positive rhombohedrons $p\cdot$ $(11\bar{2}1)$ and $m\cdot$ $(44\bar{8}1)$. The negative scalenohedrons Θ $(\bar{4}\bar{1}51)$ is generally rounded, while X $(\bar{2}\bar{3}\cdot\bar{8}\cdot 31\cdot 7)$ was represented in one crystal only by a full complement of faces, giving only fair signals. The positive scalenohedron X: $(19\cdot 1\cdot\bar{2}\bar{0}\cdot 1)$ is invariably striated parallel to the edge p'/X. The basal plane is very much etched in every case, giving prac

TABLE IV.—CALCITE, KYOGLE, NEW SOUTH WALES

Form	Measured.		Calculated.		Error	
	ϕ	ρ	ϕ	ρ	ϕ	ρ
	° ′	° ′	° ′	° ′	′	′
$p\cdot$ $(11\bar{2}1)$	30 00	44 37	30 00	44 36	0	1
$m\cdot$ $(44\bar{8}1)$	30 00	75 47	30 00	75 47	0	0
$\xi\cdot$ $(\bar{4}\bar{4}83)$	29 48	52 15	30 00	52 45	12	30
$\psi\cdot$ $(\bar{5}\cdot\bar{5}\cdot 10\cdot 2)$	30 00	68 01	30 00	67 55	0	06
Θ $(\bar{4}\bar{1}51)$	11 16	68 58	10 53	69 02	23	4
X: $(19\cdot 1\cdot\bar{2}\bar{0}\cdot 1)$	2 38	85 05	2 32	84 51	6	14
X $(\bar{2}\bar{3}\cdot\bar{8}\cdot 31\cdot 7)$	14 00	66 24	14 23	66 12	23	12

tically no signal of any value. The crystals are usually attached by a plane approximately parallel to the basal plane, and only very rarely are they doubly terminated.

3. The small amber-coloured rhombohedrons were found only in one place, deposited on the chabazite of the breccia, covering an area of about four square feet. They are generally much etched, the positive rhombohedrons $p^{\cdot}$ $(11\bar{2}1)$ and m $(44\bar{8}1)$ being the least affected. The negative scalenohedron $\psi^{\cdot}$ $(\bar{5}\cdot\bar{5}\cdot10\cdot2)$ is always etched as shown in the figure. A small basal plane is developed in all crystals. The plane of attachment is approximately parallel to $m^{\cdot}$ $(44\bar{8}1)$.

Analcite.

Analcite occurs mostly in the small vesicles of flows Nos. 1 and 2. It is generally associated with green chlorite, upon which it is deposited, and which occurs as inclusions in many of the crystals. One minute crystal was found associated with mesolite deposited on chabazite, but in every other case chabazite was deposited on analcite. The largest individual crystal of chabazite, measuring twenty-eight millimetres in diameter, found at the quarry, was deposited on analcite. The association of chabazite and analcite is quite rare, and is confined to near the surface of No. 2 flow. Calcite of the second type is often found deposited on the analcite, which is always water-clear. Two forms have been identified, the trapezohedron and the cube, though the latter appears to be extremely rare, as it was found to be present on only one crystal out of a great number examined, and then the faces were very small. The crystals did not exceed four millimetres in diameter.

An analysis of the mineral is given in Table V, and it is compared with analcite from Ben Lomond, New South Wales. A marked difference in the lime content of the two analcites is shown. Lime is absent from the Kyogle mineral, but constitutes 1·33 per cent. of the Ben Lomond mineral.

Table V.—Chemical Analysis of Analcite.

	Kyogle.	Ben Lomond.[7]	Theoretical.
SiO_2	54·23	54·39	54·5
Al_2O_3	23·67	21·76	23·2
Fe_2O_3	Absent	—	—
CaO	Absent	1·33	—
Na_2O	13·81	13·77	14·1
K_2O	Trace	Trace	—
H_2O	8·34	8·71	8·2
	100·05	99·96	100·0

The specific gravity is 2·286.

[7] Anderson.—*Loc. cit.*

Mesolite.

Mesolite is found deposited mostly on the chabazite of the breccia. Occasionally it is deposited on calcite in spaces which have been formed by the interlacing of large calcite crystals. The basal planes of the chabazite-covered calcite crystals were coated with mesolite in almost every case, while no trace of the mineral existed on the scalenohedron faces, except where deposited directly on the calcite as noted above. Only rarely was it found on the chabazite lining the larger cavities of the brecciated zone, more commonly it occurred in the smaller cavities. Except for the basal planes of the calcite crystals, the more or less confined spaces appeared to provide the conditions most favourable for the deposition of mesolite.

It occurred as delicate somewhat diverging tufts, or forming a drusy surface. Individual crystals are acicular and rarely exceed one millimetre in length. They are colourless, but in the mass appear to be white.

The quantity of mesolite was so small that it was impossible to obtain much for analysis without destroying a large number of the specimens. Less than a quarter of a gram was used for analysis and the results are given in Table VI. The water was determined by difference, but the results obtained definitely place the mineral as mesolite.

Table VI.—Chemical Analysis of Mesolite.

	Kyogle.	Ben Lomond.[a]
SiO_2	44·40	43·88
Al_2O_3	26·53	27·14
CaO	11·48	7·03
Na_2O	3·72	10·48
K_2O	—	Trace
H_2O (diff.)	13·87	11·86
	100·00	100·39

Chlorite.

No attempt was made to analyse this mineral and it is not possible to state to which particular member of the chlorite group it belongs. It is a fibrous green variety and therefore belongs to the leptochlorite of Tschermak. Besides being an interstitial mineral of the rock itself, it often forms an extremely thin lining on the walls of the vesicles of the rock.

[a] Anderson.—*Loc. cit.*

Paragenesis.

The distribution of the minerals in the different flows as exposed in the quarry face is shown below.

Flow No. 4.—Chabazite (2), calcite (1).

Flow No. 3.—Chabazite (2), calcite (1).

Breccia under Flow No. 3.—Clayey zeolitic material (3), chabazite (5), calcite (2), chabazite (1), mesolite (4), analcite (7), calcite (6).

Flow No. 2.—Chlorite (3), analcite (1), chabazite (4), calcite (2).

Flow No. 1.—Chlorite (3), analcite (2), calcite (1).

The numeral after each mineral indicates approximately the order of abundance in which the mineral was found in the respective flows. The breccia contained more zeolites and calcite than all the flows combined. The vesicular portion of No. 4 flow was not exposed, and only two specimens were obtained from here, consequently the distribution of the minerals in this flow as given above may be subject to alteration.

The sequence of the minerals in flows No. 1 and No. 2 is quite normal, but in the case of the breccia this is not so. The clayey zeolitic material appears to be the first to be deposited, though there is definite evidence that it was also deposited after the first crop of calcite and immediately before the second chabazite. The first chabazite rests either on the amorphous material or else directly on the decomposed basalt of which the beccia is composed. Occasionally it is seen to form veins in the brecciated material, but more often it is overlain by calcite. It does not appear to attain a thickness of more than six millimetres, while the overlying calcite forms crystals of more than twenty centimetres in length. This calcite is the zonal variety previously described. In some cases the zeolite can be definitely identified as chabazite, but in other cases its identification is somewhat doubtful, but it is probably all chabazite. The zeolite has been deposited from solutions which have been injected between the zones subsequent to the deposition of the calcite and probably contemporaneously with the main deposit of chabazite. Mesolite is invariably deposited on the main chabazite. The evidence of the analcite having formed after the mesolite is based on the occurrence of one crystal of analcite, and there is no direct evidence that the calcite is later than the analcite as the two were never found in association.

The Origin of the Zeolites and Associated Minerals.

It has already been noted that in the vesicles of the various flows the normal order of the sequence of the zeolites and calcite

occurs, and this is accompanied by very little alteration of the basalt. While it is maintained that the sequence of the minerals in the breccia is not normal, the basalt forming this material has been so altered that it is possible to scrape it into powder very easily by means of an ordinary pocket-knife, and the basalt which encloses the breccia has been intensely altered for a distance of at least three centimetres. It is at once obvious that the solutions acting on the breccia have had a much more severe action on it than the solutions in the vesicles of the basalt itself. It therefore becomes necessary to seek the cause for this difference. Bailey and Grabham[9] have suggested that magmatic solutions rich in sodium carbonate, accompanying the extrusion of lava, attack it shortly after the consolidation of the groundmass. The breccia is found only where a marked irregularity of the surface of No. 2 flow forms a rough kind of basin. This would form an excellent reservoir for such a magmatic solution, while, owing to the nature of the breccia, a relatively large surface of the material would be exposed to the action of the solutions. Further, it is to be noted that the vesicles occur near the surface of the flow, where the loss of heat is most rapid, and in consequence the rate of decrease of temperature of the solution would be greater than in the breccia. The action of sodium carbonate on a labradorite-rich rock would be to form calcium carbonate, sodium silicate, and aluminium silicate, the two latter interacting to form a double silicate of sodium and aluminium, with further partial replacement of sodium by calcium in the presence of excess of calcium carbonate. The crystallization of minerals from such a solution would depend on saturation due to either addition of the solute, evaporation, or lowering of the temperature. Pressure would not be an important factor in this case. If saturation were mainly due to a lowering of the temperature, it would be expected that the minerals would be deposited in their normal order. It might be argued that they have been so deposited. Thus the clayey material, chabazite, and calcite being crystallized from one solution, the second deposit of chabazite and mesolite would be due to the introduction of another solution, while the crystallization of the analcite and second deposit of calcite would be the result of a third injection of water. However, it must be remembered that the most favourable period for the introduction of magmatic solutions into the breccia would be at the time of the actual flowing of the lava immediately above, that is No. 3 flow. It is thus apparent that the quantities of the various minerals must be taken into account. With the exception of the second deposit of chabazite, calcite occurs in far greater quantity than all the other minerals together. The first deposit of chabazite is exceedingly small compared with the calcite. This is exactly the opposite from what one would expect

[9] Bailey and Grabham.—Geol. Mag., vi, 1909, pp. 250-256.

if these minerals were the result of different injections of magmatic water derived from overlying flows. It seems more probable that they were deposited from the one solution, that is the magmatic water accompanying the extrusion of the basalt of No. 3 flow. In this case it is reasonable to suppose that the solution would contain calcium carbonate and silicates before reaching the breccia. A comparatively rapid initial loss of temperature of the solution owing to contact with the relatively cool breccia and underlying solidified flow, would be sufficient to cause the deposition of the first series of minerals, consisting of the clayey zeolitic material, chabazite, and calcite. This would be followed by a slow gradual lowering of the temperature, permitting a sufficient time for the solution to effect the complete deposition of the basalt of the breccia. During this period the principal accession would be calcium carbonate, and saturation would be controlled not so much by temperature as by this fact. Two processes would be going on simultaneously, one, the decomposition of the basalt, and the other, the deposition of calcite. It is suggested that these conditions would be favourable to the rhythmic deposition of calcite so characteristic here. After the decomposition of the basalt had been completed or nearly so, temperature would be again the most important factor in any further crystallization of minerals, so that the normal sequence of the minerals would occur. This is precisely what is found here, that is, chabazite followed by mesolite, analcite and calcite.

A NEW SPECIES OF RING-TAILED PHALANGER (*PS. LANIGINOSUS* GROUP) FROM THE BUNYA MOUNTAINS, S.E. QUEENSLAND.

By

E. Le G. Troughton and A. S. Le Souef, C.M.Z.S.

(Plate xlv, and Figure 1.)

After the 1919 annual meeting of the Royal Australasian Ornithologists' Union in Brisbane an excursion was made, from the 1st to 8th October, to the Bunya Range portion of the Great Divide, an excellent account of which was written by Mr. A. H. Chisholm.[1] Travelling 153 miles by train from Brisbane, *viâ* Toowoomba, to Dalby, which is the nearest point of importance to the range, the party traversed another thirty miles of plain country to the dry forests of the foothills, finally climbing some three miles along a scant and rocky trail winding through uninviting forest country to the camp situated "over 3,000 feet above sea-level." The camp was pitched at the northern base of the Mt. Mowbullan peak, which attains 3,700 feet and is said to be "very little lower than the highest peak of the Macpherson Range"; the actual site was in one of the perfectly open park-like stretches of country, described as being remarkably characteristic of the Bunya Range and as occurring "strangely, right in the middle of great stretches of jungle . . . with, overall, the statuesque forms of the Bunya pines."

In these very distinctive surroundings one of us (A. S. Le Souef) secured a young adult female ring-tailed opossum, the colouring of which is darker than that of any eastern form of the *Ps. laniginosus* group and of a different tone to that found in any Australian species of *Pseudochirus,* being so striking as to suggest that it is possibly the outcome of prolonged isolation in the unusual environment, and hence worthy of description as a new species. It was shot at the nest, built in a bush known as the " Wild Grape" or "Supple Jack," in dense forest which Chisholm describes as "the dimly-lit jungles of sub-tropical mountains." The red tone of the single specimen was so unusual that it was regarded as a possible mutant and stored away pending the acquisition of others, but recent consideration of its unique habitat and of the allied forms, indicates that it may represent an extreme blackish-red form of the *Ps. laniginosus* group, characteristic of the dense rain forests of the Bunya Range, of which the local pine is a notable feature.

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[1] Chisholm.—The Emu, xix, 3, 1920, p. 302.

The pines, from which the range derives its name, are described as very distinctive of the area, and, as Chisholm says, "look where you will on these highlands the gaze must ever be arrested" by them; he then quotes Andrew Petrie as measuring ordinary-sized trees 150 feet high and about four feet in diameter, and as saying that "The fruit of this pine is a large cone or core, about 9 by 6 inches, and covered with small cones, similar in appearance to a pineapple. It is these small nuts that the blacks eat"; the natives are said to have been very fond of them and to have gathered in the appropriate seasons for what were literally huge picnics. It is possible that the flavour, so attractive to aborigines, may have resulted in the nuts forming part of the diet of the phalangers and thus have possibly influenced the slight cranial and dental differences, apart from forming an added inducement to isolation, while the presence of the pines and thick jungle associated with them may similarly have affected the striking coloration.

Relevant to the above, in response to our inquiry Mr. C. T. White, Government Botanist of Queensland, who accompanied the R.A.O.U. party to the Bunyas, has very kindly forwarded the following: "I do not know if the Ring-tail Opossum would eat the Bunya nuts, but I should certainly think so, as they are so large and full of food material and afford an article of diet to so many scrub animals.

"The Bunya Range is an isolated piece of country rising a good deal higher than the immediate surrounding hills and plains. In consequence of this it has a much higher rainfall than any of the immediate neighbouring places, up to 37 or 38 inches per annum, whereas the nearest approach to it is Nanango[2] with a rainfall of only 31 ins. In consequence of this there are many distinctive plants common on the Bunyas, which one does not find either in the plain country or the hills country to the east and south until one reaches the higher parts of the Blackall Ranges and Macpherson Ranges respectively."

Apart from this, there is an important indication of range restriction provided by the distribution of the Bunya pines, which occur sparsely in the Blackall Ranges to the north but are non-existent in the Macpherson Ranges to the south. A further indication of the possible isolation of the phalanger is shown by the non-occurrence in the Bunyas of the Albert Lyre-bird (*Menura alberti*), which is plentiful in the National Park of the Macphersons, and the Rufous Scrub-bird (*Atrichornis*), also found in that Park.

Though it may not be quite evident how definite or efficacious is the barrier to an extension southward of this highland form, the foregoing would suggest that a barrier does exist. There is, indeed,

[2] About 20 miles north-east of Mt. Mowbullan, altitude 1,132 feet.

a pronounced dip immediately south of Crow's Nest, a little south-east of Mt. Mowbullan, to the flat plain country around Toowoomba, where the railway crosses at the altitude of 1,921 feet; this elevated plain country appears to obliterate any trace of the Bunya Mountain flora or other characteristics, and extends southward for a considerable distance before giving rise to the Wyreema Range, which joins the Macphersons.

Comparison with Allied Forms.

It is noteworthy that the ruby tone of this sub-tropical, mountain-jungle form of Queensland almost parallels the coppery tones of the highland New Guinea species of the sub-genus *Pseudochirops,* which are variously described as silvery, shining, or uniform, coppery brown. The Queensland specimen, however, lacks their dark dorsal stripe, and has a white tail-tip not present in the New Guinea forms of *Pseudochirops,* while its ear is typical of the sub-genus *Pseudochirus* in being longer than broad; the sole Australian representative of the former sub-genus, *Ps. archeri,* has the white tail-tip, but absence of the ruby or coppery tone, and the sub-generic characters of the dorsal stripe and shape of the ear immediately distinguish it. Not only, therefore, does the coloration of the Bunya female appear to parallel that of some New Guinea forms, but there seems no reason to doubt that the rubaceous-chestnut tone, with its intermingling of black dorsally, distinguishes it from any form of the genus described hitherto.

The "rusty-red" form described and figured by Gould[3] under the name *Phalangista cookei* (*nec.* Desmarest) appears to be nearest to the Bunya form, but comparison with Gould's plate shows the red of his dark upper figure to be of an entirely different tone. In this regard it may be further noted that close comparison with the colours listed by Matschie for his holotype of *Ps. pulcher,*[4] proposed to replace the preoccupied name of Gould's *cookei,* shows not only that his colours do not agree very well with the plate but also that they are not at all applicable to the Bunya specimen.

It may be noted here, as indicative of the peculiar conditions ruling in the Bunya region and the distinctness of the deep red form occurring there, that the highland races of the Tumut district of south-eastern New South Wales and the Cairns tableland of north-eastern Queensland, in altitudes approximating to 3,000 feet, are both uniformly greyish and have shorter molar-rows and longer hind feet.

In view of the above, coupled with the diagnostic characters detailed below, it would seem that the highland female represents

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[3] Gould.—Mammals Austr., i, 1856, p. xxv, pl. xviii.

[4] Matschie.—Sitzb. Ges. Natf. Freunde, Berlin, 1915, No. 4, p. 84.

an extreme and distinct phase of a rusty-red form, such as Gould described, which has developed independently during a prolonged period of isolation, or even merely as a result of the altitude and characteristic surroundings. There appears to be no doubt, however, that it represents a specifically distinct form which may be described as follows:

PSEUDOCHIRUS RUBIDUS *sp. nov.*

An unusually coloured form, in which the rubaceous chestnut of the sides and limbs contrasts markedly, though not sharply, with the back, which is grizzled blackish and buffy brown, with a peculiar ruby or coppery tone throughout. The very dark coloration of the single female suggests that the male will probably prove to be the lighter of the sexes.

Colour.—A scintillating or iridescent ruby or coppery sheen is present which it is impossible quite to realize in colour charts or figures. It was at first considered to be about "reddish old copper" of Dauthenay's Repertoire, pl. 96, but closer comparison showed his "ruby" of pl. 158 to come nearest to the striking tone of the holotype, especially if the colour plate is slanted to eliminate the metallic sheen.

The general colour of the back is perhaps best summed up as grizzled buffy-russet black, with the black predominating in the centre, and the buffy tipping more pronounced on the sides; the basal two-thirds of the fur is nearest deep neutral grey (Ridgway, 1912), succeeded by about a 4 mm. band of palish rubaceous chestnut tipped with shining light buff and whitish, over all of which in certain lights and angles is seen the ruby tinge. The outsides of the limbs and lower sides of the body are about chestnut (Ridgway) washed with ruby (Dauthenay, 1905); the head is a warmer chestnut with a strong tipping of black between and behind the ears. Backs of ears about tawny russet, paler at the hinder border but without any trace of a white spot. Upper surface of manus and pes of the same rich ruby chestnut as the limbs. The centre of the undersurface is pale russet of Ridgway, with a very pale area on the throat; basally the hairs are pale grey. Tail auburn-blackish above and coppery-chestnut below for basal three-fifths; distal two-fifths buffy white.

External characters.—The fur of the back is longer, denser and possibly slightly more crimped than in *laniginosus* from New South Wales; the main fur on the centre of the back measures about 22 mm., interspersed with longer black hairs about 28 mm. long. Ear decidedly smaller than in any of the races of *laniginosus*. Hind-foot comparatively small, about the minimum for adults of the allied species; much smaller (5 - 7·5 mm.) than in Matschie's *pulcher*.

Skull.—The posterior palatal foramina appear to provide the most notable character, being quite small (3·5 × 2·8 mm.) and intermediate in size between the very large ones found in most southern specimens of *laniginosus* and the very small, sometimes non-existent, ones of the Tasmanian *cooki*. The largest posterior foramina in a series of twelve *cooki* is 2·8 × 1·7, while the smallest in over twenty *laniginosus* of various localities is 5·5 × 3·5 and these seem to be mere perforations in a dried membrane as the true bony openings (9·2 × 3·5) appear to be traceable beneath; the true bony posterior foramina in *laniginosus* range from 6·2 × 3·6 to 11·2 × 4 mm. The constriction is comparatively broad, being wider than in crania of *laniginosus* of a similar basal length.

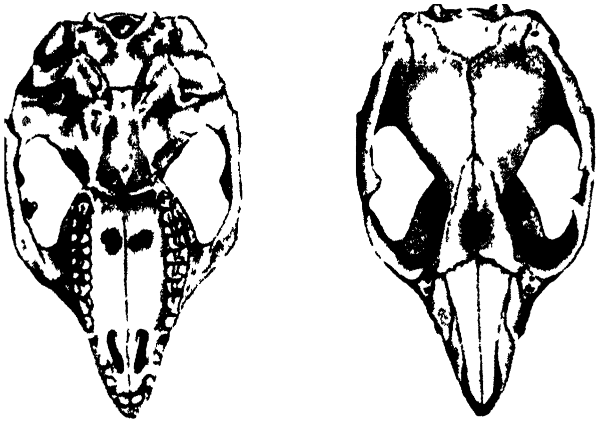

Figure 1.

Dentition.—The length of m^{1-3} is as in the larger-toothed races of *laniginosus*, but p^4 is shorter than in any south eastern race of that species, measuring 2·8 as opposed to a range of 3·1–3·5 mm. in over twenty specimens.

Dimensions.—Filled out skin of the holotype: head and body 292; tail 300; ear, length from inner base 23, outer base 24·5; breadth 17·5; hindfoot 42·5 mm.

Skull: basal length 54; zygomatic breadth 32·8; nasals 21·8 × 9·2; constriction 7·8; palate length 32·2; palatal foramina, anterior 6·2, posterior 3·5 × 2·8 and 2·2 × 2·7; pm^4 2·8 × 2·4; molars, ms^{1-4} 15·2, ms^{1-3} 12·2.

Holotype.—Young adult female. Australian Museum No. M.2791. Shot at the nest, in dense forest, by the late Mr. Fred. Morse, a well-known ornithologist, in early October, 1919, and presented to the Museum by Mr. A. S. Le Souef.

Habitat.—The Bunya Range, south-eastern Queensland. Holotype from a little north of Mt. Mowbullan, at 3,000 feet.

The rich red of the limbs and sides, and heaviness of the black pencilling on the back, with the suffusion of ruby, as well as the size and character of the posterior palatal foramina, and the shorter fourth premolar, readily distinguish this species from all known forms of the *peregrinus-laniginosus* group.

The authors are greatly indebted to Miss Ethel A. King for the faithful and lifelike coloured figure, to which so much care was devoted in achieving accuracy for the elusive and changing shades, and also for the text-figure of the skull. They are also indebted to Mr. C. T. White, Government Botanist of Queensland, for the very useful notes quoted in the introduction, and to the Senior Taxidermist of the Australian Museum, Mr. H. S. Grant, for helpful interest in regard to the sorting and comparison of a comprehensive series of ring-tailed phalangers, and to the Assistant Taxidermists, Messrs. J. H. Wright and W. Barnes as well.

NAMES OF FISHES IN MEUSCHEN'S INDEX TO THE "ZOOPHYLACIUM GRONOVIANUM."

By

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The "Zoophylacium Gronovianum" is a well known book on animals which was published in 1763. The Latin names given to the species described therein by L. T. Gronow were binary but not consistently binomial and cannot therefore be utilized in taxonomy. In 1781 another edition of the "Zoophylacium" appeared which was a replica of the 1763 original, but at least some copies of it possessed an excellent index in which *binomial* names, mostly Linnean in origin and all based on the Linnean system, were given to Gronow's genera and species by F. C. Meuschen.

Very few zoologists seem to have been aware of Meuschen's compilation or much argument over the Gronovian names might have been avoided. The Australian Museum is fortunate in possessing a copy of the index, as it is evidently very rare. Sherborn does not quote it in his wonderful "Index Animalium," nor is it in Dean's "Bibliography of Fishes," and, so far as I know, Meuschen's 1781 names are only in general use amongst the conchologists who are indebted to Dall[1] for tabulating them. I am obliged to Mr. Tom Iredale for calling my attention to Meuschen's index several years ago. I am now able to offer a collation of the fish names which appeared therein and feel that these will prove important to ichthyologists generally. The mammals, reptiles, amphibia, insecta, vermes, and zoophyta claim the attention of others.

Besides giving binomial names to Gronow's species, Meuschen also indexed ordinal, family, and vernacular names but those are not considered in this paper. He also sometimes appeared to give more than one name to a Gronovian species-number or failed to supply a number to a name, but these discrepancies are due to obvious misprints or the use of a wrong font of type and have been rectified in the collation given below.

Several new specific names were introduced for fishes by Meuschen in 1778 and 1781 (see bibliography, *infra*); the former are indicated in the list below by an obelisk (†) and the latter by an asterisk (*). Some of these will be found to invalidate the use

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[1] Dall.—Nautilus, xxxvii, 1923, pp 44-52; Iredale, Rec. Austr. Mus. xv, 1927, pp. 327-328.

of later names proposed for Gronow's polynomials: *Gobius albula* Meuschen is an earlier name than *Gobius gronovii* Gmelin for the Portuguese Man-o'-War Fish (*Nomeus*). It is, however, obviously impracticable to work out the synonymy and nomenclature of each species mentioned by Meuschen as that would involve the study of the fishes of Brazil, the East and West Indies, South Africa, and other regions. The fish names are therefore presented here with the addition of the authorities for the species and occasional remarks of my own enclosed in brackets.

Opinion 20 of the International Commission on Zoological Nomenclature stated that Gronow's 1763 genera "are to be accepted as complying with the conditions prescribed . . . to render a name available under the Code," but the Commission later suspended this ruling and eliminated Gronow 1763 from consideration as respects its systematic names (Opinion 89). Thus the genera as well as the species of Gronow are rejected by taxonomists. Some of them were used by Scopoli in 1777 but others may have to date from 1781, when Meuschen used them. In the index, alternative generic names are sometimes given to a species or a group of species. An example of this is "*Cynœdus* s[eu] *Sparus mormyroides*." In cases of this kind, Mr. Iredale considers that the former genus mentioned is relegated to the synonymy of the latter, or, in the example selected, *Cynœdus* (Gronow) Meuschen = *Sparus* Linnæus, and many of Gronow's generic names are thus made absolute synonyms of Linnean ones. The writer, however, prefers the interpretation that Meuschen was uncertain which of two generic names should be employed and therefore gave both as alternatives.

Little appears to have been recorded in scientific literature concerning the life of Friedrich Christian Meuschen of Saxe Hildburghausen. He was born in 1719 and died about 1790, having outlived Gronow, who had been his junior. The index was prepared after Gronow's death, as may be deduced from the dedication in the third fasciculus of the "Zoophylacium" and from the remarks of Walbaum (see bibliography). Meuschen appears to have written mainly on conchological subjects and evolved his own system of classifying molluscs. His writings are listed in Sherborn's "Index Animalium," the "Catalogue of the Library of the British Museum (Natural History)," and Engelmann's "Bibliotheca." A genus of fishes has been named *Meuschenia* in his honour.

Gronow's Page	Gronow's Serial No.	Meuschen's Identification.
29	139	Balæna musculus [Linnæus, 1758]. (A whale)
30	140*	Acipenser helena [Meuschen, sp. nov.].
31	141†	Calloryncbus seu Chimæra calloryncbus [Meuschen 1788—*fide* Sherborn] (= *Chimæra callorhynchus* Linnæus 1758) Figured by Gronow, pl. iv, figs. 1-2.

GRONOW'S PAGE.	GRONOW'S SERIAL NO.	MEUSCHEN'S IDENTIFICATION.
	142	Squalus mustelus [Linnæus 1758].
32	143	,, carcharias [Linnæus 1758].
	144	,, catulus [Linnæus 1758]
	145	,, stellaris [Linnæus 1758].
	146	,, sp. [= *zygæna* Linnæus 1758.]
33	147	,, maximus [Linnæus 1766].
	148	,, pristis [Linnæus 1758].
34	149	,, acanthias [Linnæus 1758].
	150*	,, colax [Meuschen, sp. nov.].
	151	,, squatina [Linnæus 1758].
35	152 (as 158, part)	Raja altavela [Linnæus 1758].
	153	,, torpedo [Linnæus 1758]. Figured by Gronow, pl. ix, fig. 3.
36	154	,, clavata [Linnæus 1758].
	155	,, miraletus [Linnæus 1758].
	156	,, rhinobatos [Linnæus 1758].
37	157	,, batis [Linnæus 1758].
	158	,, pastinaca [Linnæus 1758].
38	159	Petromyzon fluviatilis [Linnæus 1758]
	160	,, branchialis [Linnæus 1758].
	161	Muræna cæca [Linnæus 1758].
39	162	,, helena ? [Linnæus 1758].
	163*	,, helena rostrata [Meuschen, var. nov.]
40	164*	,, helena fasciata [Meuschen, var. nov.].[2]
	165*	,, helena punctata [Meuschen, var. nov.].
	166	,, anguilla [Linnæus 1758, as *anguilla*].
41	167 (107 in error)	Gymnotus rostratus [Linnæus 1766].
	168	,, carapo [Linnæus 1758].
	169	,, electricus [Linnæus 1766]. Figured by Gronow, pl. viii, figs. 1-3.
43	170	Syngnathus hippocampus [Linnæus 1758].
	171	,, sp. [probably *S. marinus* Linnæus 1762.]
	172	,, acus [Linnæus 1758].
	172β	,, sp. [= *typhle* Linnæus 1758.]
44	173	Ostracion cubitus [Linnæus 1766 = *O. cubicus* Linnæus 1758].
	174	,, tuberculatus [Linnæus 1758].
45	175	,, cornutus [Linnæus 1758].
	176*	,, quadricorniformis [Meuschen, sp. nov.]
	177	,, quadricornis [Linnæus 1758].
46	178	,, trigonus [Linnæus 1758].
	179	,, triqueter [Linnæus 1758].
47	180	,, echinatus [= *Diodon echinatus* Linnæus 1758].
	180β	,, atringa [= *Diodon atringa* Linnæus 1758].
	180γ	,, reticulatus [= *Diodon reticulatus* Linnæus 1758].
	181	,, holocanthus [= *Diodon holocanthus* Linnæus 1758].
	181β	,, hystrix [= *Diodon hystrix* Linnæus 1758].
48	182	,, hispidus [= *Tetraodon hispidus* Linnæus 1758].
49	183*	,, lagocephaloides [Meuschen, sp. nov.].

[2] Meuschen's varietal name preoccupies *Muræna fasciata* Thunberg 1789 which is a synonym of *Muræna colubrina* Boddært 1781, a species of *Chlevastes* (*fide* Weber and Beaufort, Fish. Indo-Austr. Archip., iii, 1916, p. 285).

GRONOW'S PAGE.	GRONOW'S SERIAL NO.	MEUSCHEN'S IDENTIFICATION.
50	184	Ostracion lagocephalus [= *Tetraodon lagocephalus* Linnæus 1758].
	185	„ mola [= *Tetraodon mola* Linnæus 1758].
	186*	„ cathetoplateus [Meuschen, sp. nov.].
51	187	Balistes aculeatus [Linnæus 1758].
	188	„ verrucosus [Linnæus 1758].
	189	„ sp. [= *chinensis* Bloch 1786 = *sinensis* Forster 1771, *ex Balistes chinensis* Osbeck 1765, translation of pre-Linnean work.]
52	190	„ ringens [Linnæus 1758].
	191	„ tomentosus [Linnæus 1758]. Figured by Gronow, pl. vi, fig. 5.
	192	„ aculeatus ? [Linnæus 1758].
	193	„ monoceros ? [Linnæus 1758].
53	194†	„ spinosus [Meuschen 1778].
	195	„ vetula [Linnæus 1758].
	196*	„ amarulentus [Meuschen, sp. nov.].
54	197	Cyclopterus lumpus [Linnæus 1758].
55	198†	Cyclogaster liparis [Meuschen 1778 = *Cyclopterus liparis* Linnæus 1766 ?]. Misprinted *Cycoglaster*.
	199	Gonorynchus[a] gonorynchus [= *Cyprinus gonorhynchus* Linnæus 1766]. Figured by Gronow, pl. x, fig. 2.
56	200	Cobitis tænia [Linnæus 1758].
	201	„ fossilis [Linnæus 1758].
	202	„ barbatula [Linnæus 1758].
57	203*	Uranoscopus lyrapæus [Meuschen, sp. nov.].
	204*	„ dracunculoides [Meuschen, sp. nov.].
	205	„ dracunculus [= *Callionymus dracunculus* Linnæus 1758].
	206	„ lyra [= *Callionymus lyra* Linnæus 1758].
58	207	Lophius piscatorius [Linnæus 1758].
	208	„ histrio [Linnæus 1758].
	209	„ vespertilio [Linnæus 1758].
	210*	„ thymelicus [Meuschen, sp. nov.].
59	211	Sciæna umbra [Linnæus 1758].
	212	„ cirrosa ? [Linnæus 1758].
60	213	Cynædus s. Sparus hurta ? [Linnæus 1758] (or) rhomboides [Linnæus 1766].
	214	„ „ denter [errore pro *dentex*, Linnæus 1758].
61	215	„ „ erythrinus [Linnæus 1758].
62	216*	„ „ mormyroides [Meuschen, sp. nov.].
	217	„ „ chromis ? [Linnæus 1758].
	218	„ „ salpa ? [Linnæus 1758].
63	219	„ „ sargus [Linnæus 1758; *Cynædus sargus* Meuschen 1778].
	220	„ „ aurata [Linnæus 1758].
64	221	„ „ mormyrus [Linnæus 1758; *Trichopterus indicus* Gray 1854]. Figured by Gronow, pl. x, fig. 1.
	222	Sparus saxatilis [Linnæus 1758].
	223*	„ punctatus [Meuschen, sp. nov.]. Figured by Gronow, pl. v, fig. 4.

[a] Also spelt thus by Scopoli (Intr. Hist. Nat., 1777, p. 450), to whom the genus should be credited.

GRONOW'S PAGE.	GRONOW'S SERIAL NO.	MEUSCHEN'S IDENTIFICATION.
65	224	Holocentrus s. Perca atraria ? [Linnæus 1766].
	225	„ „ sp. [= *rostratus* Gray 1854.] Figured by Gronow, pl. iv, fig. 3.
66	226*	Coracinus s. Sciæna corrosus [Meuschen, sp. nov.].
	227*	„ „ unimaculata [Meuschen, sp. nov.]. (See Whitley, Mem. Qld. Mus. ix, 3, 1929, p. 233.)
67	228	Scarus s. Labrus turdus [Linnæus 1758].
	229*	„ „ ocellatus [Meuschen, sp. nov.] (or) saxatilis ? Figured by Gronow, pl. vi, fig. 3. Not *Labrus ocellatus* Forskaal 1775 [non-binomial].
	230*	„ „ saxatiliformis [Meuschen, sp. nov.].
68	231	Chætodon arcuatus [Linnæus 1758].
69	232	„ ciliaris [Linnæus 1758].
	233	„ rostratus [Linnæus 1758].
	234	„ macrolepidotus [Linnæus 1758].
70	235	„ striatus [Linnæus 1758].
	236	„ pinnatus [Linnæus 1758].
	237	„ capistratus [Linnæus 1758].
	238	Labrus julis ? [= *julis* Linnæus 1758].
71	239	„ griseus ? [Linnæus 1758].
	240*	„ polyodon [Meuschen, sp. nov.].
	241	„ julis [Linnæus 1758].
	242	„ lunaris [Linnæus 1758]. Figured by Gronow, pl. vi, fig. 2.
72	243*	„ torquata [Meuschen, sp. nov. (? *non* Walbaum 1792)].
	244†	Callyodon s. Labrus cretensis [= *Callyodon cretensis* Meuschen 1778]. Figured by Gronow, pl. vii, fig. 4.
	245	„ „ sp. [= *scriptus* Gray 1854.]
	246	Pleuronectes sp. [= *platessa* Linnæus 1758.]
73	247	„ hippoglossus [Linnæus 1758].
	248	„ flessus [= *flesus* Linnæus 1758].
	249	„ linguatula [Linnæus 1758].
	250	„ lineatus [Linnæus 1758] (or) tricho-dactylus [Linnæus 1758].[4]
74	251	„ solea [Linnæus 1758].
	252	„ cynoglossus [Linnæus 1758].
	253	„ rhombus [Linnæus 1758].
	254	„ maximus [Linnæus 1758; *P. rhombus* Gray 1854].
75	255*	„ soleaoidea [Meuschen, sp. nov.].
(255, part, in error)	256	Echeneis remora [Linnæus 1758].
	257	„ neucrates [Linnæus 1758].
	258	Blennius superciliosus [Linnæus 1758]. Figured by Gronow, pl. v, fig. 5.
76	259	„ pholis [Linnæus 1758].
	260	„ mustelaris [Linnæus 1758].
	261*	„ superciliosiformis [Meuschen, sp. nov.].
	262	„ sp. [= *retusifrons* Gray 1854.]

[4] Meuschen's identifications of no. 250 appear to be wrong as the species is evidently *P. achirus* Linnæus.

Gronow's Page.	Gronow's Serial No.	Meuschen's Identification.
	263	Blennius cristatus [Linnæus 1758; *Adonis cristatus* Gray 1854]. Figured by Gronow, pl. vi, fig. 4.
	264	„ gattorugine [Linnæus 1758; *Adonis cornutus* Gray 1854].
77	265	Enchelyopus s. Blennius viviparus [Linnæus 1758].
(255, part, in error)		
	266	„ „ lumpenus ? [= *Blennius lumpenus* Linnæus 1758; *Enchelyopus lumpenus* Meuschen 1778].
78	267	Pholis s. Blennius grunellus [errore pro *Blennius gunnellus* Linnæus 1758].
	268	Cottus scorpius [Linnæus 1758].
79	269*	„ grunensis [Meuschen, sp. nov.] (replaces *Callionymus niqui* Gray 1854).
	270	„ gobio [Linnæus 1758].
	271	„ cataphractus [Linnæus 1758].
	272	„ quadricornis [Linnæus 1758].
80	273	Amia calva [Linnæus 1766].[5] Figured by Gronow, pl. ix, fig. 2.
	274	Trachinus draco [Linnæus 1758].
81	275	Gobius paganellus [Linnæus 1758].
	276	„ aphya [Linnæus 1758].
82	277†	„ syrmatophorus [Meuschen 1778; *Cepola unicolor* Gray 1854]. Figured by Gronow, pl. iv, fig. 4.
	278*	„ albula [Meuschen, sp. nov.].
83	279	Eleotris s. Gobius niger ? [Linnæus 1758].
	280	„ „ niger [Linnæus 1758].
	281	„ „ eleotris [Linnæus 1758; *Eleotris eleotris* Meuschen 1778].
84	282	Trigla cataphracta [Linnæus 1758].
	283	„ gurnardus [Linnæus 1758].
	284	„ lucerna [Linnæus 1758].
85	285	„ volitans [Linnæus 1758; *Gonocephalus macrocephalus* Gray, 1854].
	286	Mullus barbatus [Linnæus 1758].
86	287*	Perca monopteros [Meuschen, sp. nov.].
	288	„ cernua [Linnæus 1758].
	289	„ schrætser [Linnæus 1758].
87	290	„ scrofa [= *Scorpæna scrofa* Linnæus 1758].
	291	„ porcus [= *Scorpæna porcus* Linnæus 1758].
88	292*	„ horrida minor [Meuschen, var. nov.] }
	293*	„ horrida major [Meuschen, var. nov.] } [Varieties of *Scorpæna* (= *Synanceja*) *horrida* Linnæus 1766]. No. 292 is figured by Gronow, pl. xi, fig. 1; pl. xii, fig. 1; and pl. xiii, fig. 1.
89	294	„ volitans [= *Gasterosteus volitans* Linnæus 1758].
	295	„ cottoides [Linnæus 1758].

[5] Wrongly identified. *Amia calva* Meuschen (*non* Linnæus) = *A. percæformis* Gray 1854. *Amia* Meuschen is preoccupied by Linnæus, 1766, and may be renamed *Gronovichthys* with *Amia percæformis* [= *Gronovichthys moluccensis* (Valenciennes), Nouv. Arch. Mus. Hist. Nat. Paris, 1882, p. 54, *Apogon*] as orthotypè. *Apogon* Lacépède (Hist. Nat. Poiss. iii, 1802, p. 411. Haplotype, *A. ruber* Lacépède = *Mullus imberbis* Linnæus) appears to be distinct.

GRONOW'S PAGE.	GRONOW'S SERIAL NO.	MEUSCHEN'S IDENTIFICATION.
90	296	Perca polyma [errore pro *P. polymna* Linnæus 1758].
	297	„ diagramma [Linnæus 1758].
91	298	„ guttata ? [Linnæus 1758].
	299	„ lucioperca [Linnæus 1758].
	300	„ labrax [Linnæus 1758].
	301	„ sp. [= *vulgaris* Gray 1854.]
92	302*	„ lucius [Meuschen, sp. nov.].
	303	„ asper [Linnæus 1758].
93	304	Scomber scombrus [Linnæus 1758].
	305	„ thynnus [Linnæus 1758].
94	306	„ cordyla [Linnæus 1758].
	307*	„ cordylaoides [Meuschen, sp. nov.].[6]
	308	„ trachurus [Linnæus 1758].
	309	„ ductor [= *Gasterosteus ductor* Linnæus 1758].
95	310	„ pelagius [errore pro *S. pelagicus* Linnæus 1758; *Sarda immaculata* Gray 1854].
96	311	Zeus faber [Linnæus 1758].
	312	„ vomer [Linnæus 1758].
97	313	Gadus lota [Linnæus 1758].
	314	„ mustela [Linnæus 1758].
	315	„ merluccius [Linnæus 1758; *Merlucius lanatus* Gray 1854].
98	316	„ merlangus [Linnæus 1758].
	317	„ virens [Linnæus 1758].
	318	„ pollachius [Linnæus 1758].
99	319	„ morhua [= *callarias* Linnæus 1758].
	320	„ barbatus [Linnæus 1758].
	321	„ aeglefinus [Linnæus 1758].
100	322	Clarias s. Silurus sp. [= *anguillaris* Linnæus 1758.] Figured by Gronow, pl. viiia, figs. 3-5.
101	323	Silurus glanis [Linnæus 1758]. Figured by Gronow, pl. vi, fig. 1.
102	324†	Aspredo s. Silurus fluviatilis [= *Aspredo fluviatilis* Meuschen 1778].
	325†	„ „ myrtus [errore pro *Aspredo mystus* Meuschen 1778]. Figured by Gronow, pl. v, fig. 3.
	326	„ „ aspredo [= *Silurus aspredo* Linnæus 1758].
	327	Albula s. Salmo albula [= *Salmo albula* Linnæus]. (Tautotype of the genus *Albula* Scopoli, 1777.)
103	328	Cyprinus tinca [Linnæus 1758].
104	329	„ gobio [Linnæus 1758].
	330	„ carpio [Linnæus 1758].
	331	„ barbus [Linnæus 1758].
105	332	„ nasus [Linnæus 1758].
	333	„ cephalus [Linnæus 1758].
	334	„ dobula [Linnæus 1758].
106	335	„ orfus ? [Linnæus 1758].
	336	„ alburnus [Linnæus 1758].
	337	„ idbarus [Linnæus 1758].
107	338*	„ rutiliformis [Meuschen, sp. nov.].
	339	„ rutilis [Linnæus 1758].
	340	„ erytrophthalmus [errore pro *erythrophthalmus* Linnæus 1758].

[6] See Whitley, Rec. Austr. Mus. xv, 1927, p. 300.

Gronow's Page.	Gronow's Serial No.	Meuschen's Identification.
108	341	Cyprinus aspius [Linnæus 1758].
	342	„ auratus [Linnæus 1758]. (Varieties α, β, etc. of Goldfish not named.)
109	343	„ carassius [Linnæus 1758].
110	344	„ ballerus [Linnæus 1758].
	345	„ brama [Linnæus 1758].
111	346	„ orfus [Linnæus 1758].
	347	Clupea alosa [Linnæus 1758].
	348	„ harenchus [errore pro *C. harengus* Linnæus 1758].
	348β	„ sprattus [Linnæus 1758].
112	349	Argentina sphyræna [Linnæus 1758].
	350*	„ carolina [Meuschen, sp. nov.].
	351	Synodus s. Esox synodus [= *Esox synodus* Linnæus 1758; *Synodus synodus* Meuschen 1778]. Figured by Gronow, pl. vii, fig. 1.
113	352	Hepatus s. Stromateus javus [= *Teuthis javus* Linnæus 1766]. Figured by Gronow, pl. viii, fig. [4].
	353*	„ „ seserinus [Meuschen, sp. nov.].[7]
114	354	Erythrinus s. Cyprinus cephalus [Linnæus 1758; *Erythrinus salmoneus* Gray 1854]. Figured by Gronow, pl. vii, fig. 6.
	355†	Umbra catulus [Meuschen 1778].
115	356	Cataphractus s. Pegasus volitans [Linnæus 1758]. Figured by Gronow, pl. xii, figs. 2-3.
	357	„ „ natans [Linnæus 1766]. Figured by Gronow, pl. xi, figs. 2-3.
116	358	Exocœtus evolans [Linnæus 1766].
	359	„ volitans [Linnæus 1758].
117	360	Anableps s. Cobitis anableps [Linnæus 1758]. Figured by Gronow, pl. i, figs. 1-3.
	361	Esox lucius [Linnæus 1758].
	362	„ bellone [Linnæus 1758; *Macrognathus scolopax* Gray 1854].
118	363	„ brasiliensis [Linnæus 1758].
	364	„ osseus [Linnæus 1758].
119	365	Solenostomus s. Fistularia tabacaria [Linnæus 1758; *Flagellaria fistularis* Gray 1854].
	366	„ „ chinensis [Linnæus 1766].
120	367 (267 in error)	Salmo trutta [Linnæus 1758].
	368	„ locustris [errore pro *S. lacustris* Linnæus 1758].
	369	„ salar [Linnæus 1758].
121	370	„ salvelinus [Linnæus 1758].
	371	„ sp. [= *fario* Linnæus 1758.]
	372	„ alpinus [Linnæus 1758].

[7] Meuschen also associates the specific names *flatola* and *hepatus* with No. 353. The former is *Stromateus flatola* Linnæus 1758 and the latter, *Teuthis hepatus* Linnæus 1766. *Hepatus s. Stromateus seserinus* Meuschen is a synonym of *Teuthis hepatus* Linnæus, the genotype of *Teuthis* (see Whitley, Rec. Austr. Mus. xvi, 1928, pp. 230-231). *Acronurus fuscus* Gray 1854 is another synonym.

Gronow's Page.	Gronow's Serial No.	Meuschen's Identification.
122	373	Salmo eperlanus [Linnæus 1758].
	374	„ oxyrinchus [Linnæus 1758].
	375	„ thymallus [Linnæus 1785].
	376	Anostomus s. Salmo anostomus [= *Salmo anostomus* Linnæus 1758; *Anostomus anostomus* Meuschen 1778]. Figured by Gronow, pl. vii, fig. 2.
123	377	Charax s. Salmo notatus [Linnæus 1766] (or) lavaretus ? [Linnæus 1758].
	378*	„ „ cynnoides [Meuschen, sp. nov.]. Figured by Gronow, pl. xiii, fig. 2.
	379	„ „ immaculatus [Linnæus 1758].
124	380	„ „ gibbosus [Linnæus 1758]. Figured by Gronow, pl. i, fig. 4.
	381	„ „ bimaculatus [Linnæus 1758]. Figured by Gronow, pl. i, fig. 5.
	382	Mystus s. Silurus bagre [Linnæus 1766].
125	383	„ „ costatus [Linnæus 1758]. Figured by Gronow, pl. v, figs. 1-2.
	384	„ „ clarias [Linnæus 1758].
	385	„ „ ascita [Linnæus 1758; *Mystus ascita* Meuschen 1778].
	386	„ „ fasciatus [Linnæus 1766].
126	387	„ „ cous [Linnæus 1766; *Mystus cous* Meuschen 1778]. Figured by Gronow, pl. viii*a*, fig. 7.
	388	„ „ anguillaris [Linnæus 1758; *Mystus anguillaris* Meuschen 1778]. Figured by Gronow, pl. viii*a*, fig. 6.
127	389	Callichthys s. Silurus callichthys [Linnæus 1758]; *Callichthys callichthys* Meuschen 1778].
	390	„ „ cataphractus [Linnæus 1758]; *Callichthys cataphractus* Meuschen 1778]. Figured by Gronow, pl. iii, figs. 3-4.
	391	Plecostomus s. Loricaria cataphracta [Linnæus 1758; *Plecostomus cataphractus* Meuschen 1778]. Figured by Gronow, pl. ii, figs. 1-2.
	392*	„ „ loricaria [Meuschen, sp. nov.].
128	393*	„ „ plecostomoides [Meuschen, sp. nov.].
	394	„ „ plecostomus [Linnæus 1766; *Plecostomus plecostomus* Meuschen 1778]. Figured by Gronow, pl. iii, figs. 1-2.
	395	Centriscus scolopax [Linnæus 1766].
129	396	„ scutatus [Linnæus 1758]. Figured by Gronow, pl. vii, fig. 3.
	397	Mugil cephalus [Linnæus 1758].

Gronow's Page.	Gronow's Serial No.	Meuschen's Identification.
130	398	Polynemus quinquarius [Linnæus 1758].
	399	[Atherina[8]] herpetus [errore pro *Atherina hepsetus* Linnæus 1758].
131	400	Anarrhichas lupus [Linnæus 1758].
	401	Ophidion imberbe [Linnæus 1758].
132	402	Mastacembelus s. Ophidion macrophtalmum [Linnæus 1758]. Figured by Gronow, pl. viii*a*, figs. 1-2.
133	403	„ „ sp. [= *pentophthalmos* Gray 1854.]
	404	Ammodytes tobianus [Linnæus 1758].
134	405	Gasterosteus aculeatus [Linnæus 1758].
	406	„ pungitius [Linnæus 1758].
	(as 407, part)	
	407	„ spinachia [Linnæus 1758].
135	408	Channa s. Labrus hepatus [Linnæus 1758]. Figured by Gronow, pl. ix, fig. 1.
	409	Gasteropelecus s. Clupea sternicla [Linnæus 1758]. Figured by Gronow, pl. vii, fig. 5.
	410†	Leptocephalus tæniola [Meuschen 1778].[9] Figured by Gronow, pl. xiii, fig. 3.
136	411	Gymnogaster s. Trichiurus lepturus [Linnæus 1758].

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[8] Meuschen omitted the generic name *Atherina* and his specific name is evidently a misprint for *hepsetus*.
[9] The earliest binomial name for the "Leptocepalus" larva of the Conger Eel, *Leptocephalus conger* (Linnæus).

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EXPLANATION OF PLATE XLV.

Pseudochirus rubidus, sp. nov. Holotype female. Locality: North of Mount Mowbullan, Bunya Range, Queensland.

Ethel A King, pinx

EXPLANATION OF PLATE XLVI.

Chabazite coating scalenohedrons of calcite from Kyogle, New South Wales. At the top centre of the specimen, a broken section of a calcite crystal is seen showing the characteristic zonal structure.

G. C. CLUTTON, photo.

PALÆONTOLOGICAL NOTES No. II:

MEIOLANIA PLATYCEPS *Owen* and VARANUS (MEGALANIA) PRISCUS (*Owen*).

By

C. ANDERSON, M.A., D.Sc.

(Plates xlvii–li.)

LIMB BONES OF MEIOLANIA PLATYCEPS *Owen*.

Since a description of this extinct chelonian was published in these RECORDS,[1] additional specimens have been secured at Lord Howe Island by the efforts of my colleague, Mr. E. Le G. Troughton, and Messrs. Baxter, Hines, and Nicholls, residents of the island. These afford further evidence regarding its structure and mode of life, for, fortunately, some of the bones were found associated in such a manner that one is justified in regarding them as belonging to one and the same individual. Thus, for the first time it is possible to draw conclusions as to the relative proportions of the limb bones.

The associated bones consist of right humerus, right radius and ulna, both femora, tibiæ, and fibulæ, left astragalo-calcaneum, and a number of tarsal, metatarsal, phalangeal, and dermal bones. Of these the radius and tibia have already been adequately described by Owen,[2] the others have not been described before.

Ulna (Pl. xlvii, figs. 1-3).—This is a stout bone, somewhat longer and heavier than the radius; its proximal end rises higher than that of the radius, but its distal end does not pass so low. It is flattened somewhat in a dorso-ventral plane and is slightly twisted, but not so much as the ulna of *Testudo*. The surface of articulation with the humerus (fig. 2) is roughly triangular in shape. There is an extensive rugose area near the proximal end for attachment to the radius. The olecranon is fairly well developed. Greatest length, 107 mm.

Fibula (Pl. xlvii, figs. 4-6).—A much slighter bone than the tibia, which it exceeds a little in length. It expands at both ends, particularly the distal, and the long axes of the proximal and distal articular surfaces are approximately at right angles to one another. Near the distal end on the tibial side is a prominent rugosity for attachment of the *ligamentum tibio-fibulare inferius*. Length, 94 mm.

[1] Anderson.—Rec. Austr. Mus., XIV, 1925, pp. 223-242.
[2] Owen.—Phil. Trans., CLXXIX, 1888, B, pp. 187-189.

Astragalo-calcaneum (Pl. xlix, fig. 2).—The proximal surface of this large composite bone is divided by a slight ridge, running in a dorso-plantar direction, into two articulating surfaces; the tibial is raised in the middle and roughly quadrangular in shape, the fibular is concave and elongated. On the dorsal surface is a diamond-shaped depression for the *ligamentum tibio-tarsale anterius*. In general shape the bone resembles that of *Testudo*. Longest measurement, 70 mm.

Tarsal, metatarsal, and phalangeal bones.—A number of these bones were found in association with the left tibia and fibula, the whole being bound together along with a number of dermal bones by the calcareous matrix. Some of the bones were still articulated, but, unfortunately, it was not found possible to restore the foot skeleton. The phalanges show well developed articulating surfaces, which indicates considerable freedom of movement in the bones of the foot.

Relative lengths of limb bones.—Taking the length of the humerus as 100, we have the following proportions:

Humerus	Radius	Ulna	Femur	Tibia	Fibula
100	53	59	101	48	52

Thus the femur is very slightly longer than the humerus, and the lower arm and leg bones are about half as long as the upper bones. These proportions indicate that *Meiolania* was adapted for progression on land.

Dermal bones.—These were found attached by matrix to bones both of the fore and hind limb, and there can be little doubt that the limbs of *Meiolania,* like those of some species of *Testudo,* were armed with dermal bones as suggested by Lydekker.[3]

It is evident that the fresh evidence now obtained confirms the view that *Meiolania* was essentially a terrestrial reptile. In walking the fore and hind limbs were bent so that the long axes of the fore-arm and of the lower leg bones were approximately at right angles to those of the humerus and femur, and, apparently, the hand and foot were parallel to the humerus and femur. In gait and posture *Meiolania* must have been very similar to *Testudo.*

In my previous paper I pointed out that, as Walpole Island is of coral origin, and has apparently never been connected with any larger land mass, the occurrence there of *Meiolania mackayi,* a form very similar to *M. platyceps,* indicates that the animal was able to cross a considerable stretch of ocean. This possibility is not excluded by its adaptation for a terrestrial existence, for *Testudo* is a good swimmer, as Beebe has pointed out.[4] But, on

[3] Lydekker.—Brit. Mus Cat Foss Rept, Part III, 1889, p 164
[4] Beebe —"Galapagos, World's End," p 228 (New York, 1924).

the whole, the skeleton of *Meiolania*, the proportions of its limb bone, the structure of its phalanges, and its heavily armoured condition, strongly indicate that it was built for life on land.

VARANUS (MEGALANIA) PRISCUS (*Owen*).

Since Owen first described this extinct lizard,[5] several authors have written on the genus. References to, and comments on, the various contributions will be found in Baron Fejérváry's comprehensive paper "Contributions to a Monography of fossil Varanidæ and on Megalanidæ";[6] he seems, however, to have overlooked De Vis' "Bones and Teeth of a large extinct Lizard,"[7] and Etheridge's "Reptilian Notes."[8]

Any additional information regarding this interesting form, the largest known lizard, is worthy of record, and I propose to describe here some recently discovered teeth, which are almost certainly megalanian, and a well preserved femur, which has been in the Museum collection for some years. I also figure an ulna, for, though a similar bone has been well described by De Vis,[9] his illustration is, as Fejérváry says, somewhat vague.

Teeth.—Recently Professor Sir Edgeworth David presented to the Australian Museum a number of fossils which he had received from Mr. Bram Collins, of Rosella Plains, Mount Surprise, near Cairns, Queensland. These consist of some fragmentary bones which cannot be identified, a few small macropod molars, and five beautifully preserved reptilian teeth. From a letter addressed to Sir Edgeworth by Mr. Collins we learn that these specimens were obtained in sinking a well through the top of a hill near the homestead in a search for a supply of household water. At a depth of about five feet a flow of basalt was encountered; the bottom of the flow was reached at twenty feet from the surface, and the fossils were found at a depth of about forty feet. The probability is that these fossils occur in a "deep lead."

The teeth are all of the same type but differ somewhat in size and proportions. Two typical teeth are figured (Pl. 1), one relatively long and slender, the other shorter and stouter. All the teeth consist of crowns only, the bases, unfortunately, having been broken off. It is, therefore, difficult to estimate what their actual lengths were, but it may be conjectured that of the longer only about two-thirds has been recovered. What remains is 28 mm. long, with an antero-posterior breadth of 13 mm. and a thickness of 7·5 mm., so that the complete tooth probably had a length of about

[5] Owen.—Phil. Trans., CXLIX, 1859 (1860), p 43, pls 7, 8; CLXXI, 1880 (1881), p. 1037, pls. 34, 36; CLXXVII, 1887, p. 327, pl. 13.
[6] Fejérváry.—Ann. Mus. Nat. Hung., XVI, 1918, pp. 341-467.
[7] De Vis.—Proc. Roy. Soc. Q'land, II, 1885 (1886), pp. 25-32, pls. i-iii.
[8] Etheridge.—Proc. Roy. Soc. Vict. (n s.), XXIX, 2, 1917, pp. 127-130, pl. viii, figs. 1-5.
[9] De Vis.—Proc. Roy. Soc. Q'land, VI, 1889 (1890), pp. 94-96, pl. iv

42 mm. The other figured tooth, of which little more than the tip of the crown is preserved, measures 19 × 14·5 × 9·7 mm.

The teeth are slightly recurved and broadly oval in section, the convexity being slightly greater on the lateral side. The anterior and posterior edges are distinctly carinated and the carinæ are beautifully and regularly serrated; the serrations extend to the fracture on the posterior edge, but on the longer teeth, the carina and serrations disappear just before this is reached. The teeth are devoid of vertical fluting, although internal striæ can be seen in the enamel layer. In colour three are light brown, the other two yellowish, and all are practically unworn.

It is apparent that these teeth are those of a gigantic lizard nearly akin to, if not actually a member of, the family Varanidæ. There is a high degree of probability that they belong to *Megalania prisca,* for there is no other known lizard large enough to have borne such teeth.

By the courtesy of Mr. H. A. Longman, Director of the Queensland Museum, I have been enabled to examine a collection of reptilian teeth preserved in that institution, as well as the maxillary fragment with three teeth *in situ,* described by De Vis under the name *Varanus dirus.*[10] Comparison with the teeth from Rosella Plains shows that the latter cannot belong to *dirus,* in which the teeth are considerably smaller, have a more decided backward curvature, slightly sigmoid, a rounded anterior border, very faintly serrated near the tip, and a compressed posterior edge, serrated but without carina. In section the teeth of *dirus* are pear-shaped, not oval.

The earliest account of the teeth of *Megalania* is contained in Owen's paper describing part of the dentary of *Notiosaurus dentatus* (= *Megalania prisca*[11]). Unfortunately, in Owen's specimen, which was discovered at Cuddie Springs, near Brewarrina, New South Wales, only the base of one tooth and portion of the base of another were preserved, so that exact comparison is not possible. About the same time De Vis described what he regarded as a tooth of *Notiosaurus dentatus* from Clifton, Darling Downs, Queensland.[12] I have not been able to recognize this specimen in the collection forwarded to me by Mr. Longman, though it contains one tooth identical in appearance with those from Rosella Plains. De Vis' figure is not good but his description is as follows: "The teeth in *Monitor* [*Varanus gouldi*], as compared with *Hydrosaurus* [*Varanus giganteus*] are broad and thick; the tooth of the latter is distinctly serrated on both edges while in the *Monitor* tooth the fore edge [sic] only is serrated and that faintly. The outline of the

[10] De Vis.—Ann. Q'land Mus., No. 5, 1900, p. 6, pl. iii
[11] Owen.—Phil. Trans., CLXXV, 1885, pp. 249-251
[12] De Vis.—Proc Roy. Soc. Q'land, II, 1885 (1886), pp. 31-32, pl. iii, fig. 2.

tooth of the extinct lizard resembles that of *Hydrosaurus* but it is proportionately thicker; its fore-edge is smooth, and also like the *Monitor* tooth it has the basal fluting extended higher on the inner side towards the crown than in *Hydrosaurus*. On the other hand its shape and the almost entire want of the ridge descending upon the outer side of the tooth sufficiently differentiate it from that of a *Monitor* proper. We have, therefore, here additional evidence that the extinct lizard had greater affinity with the smaller than with the larger of these two living genera."

"The length of this tooth is 2·1 cm., its breadth 1·2 cm.; the measurements of a middle tooth of *Hydrosaurus* are 0·6 cm. and 0·3 cm.; of *Monitor*, 0·3 cm. and 0·2 cm.; and from these elements of comparison we may estimate the entire length of the animal to have been in the mean 18ft. 6in. long."

The tooth ascribed by De Vis to *Notiosaurus* approaches in dimensions those from Rosella Plains, but he does not mention carinæ on the edges and describes the front edge as smooth. It is possible that the serrations on the front edge may have been less constantly present, or may have become worn off. It may be observed, too, that the anterior and premaxillary teeth in the varanids are smaller than the more posterior teeth, and their shape is somewhat different, the front edge being more rounded. It is possible, therefore, that the tooth described by De Vis is really that of *Megalania*, as might be conjectured from its size.

In 1917 Etheridge described an almost complete maxillary bone of a large lizard, also from Clifton, Queensland, which he identified with *Megalania prisca*, of which he regards *Notiosaurus dentatus* as a synonym.[13] This important specimen is a right maxillary with the stump of one tooth *in situ*, the decayed root of another, and the impression of the bases of seven more. Etheridge doubted whether the tooth figured by De Vis as that of *Notiosaurus* is in any way related to Owen's fossil of the same name.

The Rosella Plains teeth resemble those of *Varanus komodoensis*, as described by Burden[14] and Lönnberg,[15] though in the latter there does not seem to be any carinæ on the edges and on the anterior edge the serrations do not extend so far from the tip. Moreover the teeth of *komodoensis* seem to be less oval in section, being thickest at the base of the front side, tapering to a sharp and serrated edge on the posterior side, and the backward curvature is more pronounced.

Femur and ulna.—In the Museum collection is part of the skeleton of *Megalania*, obtained in 1892 from Mr. Hermann Lau,

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[13] Etheridge.—Proc. Roy. Soc. Vict. (n.s.), XXIX, 2, 1917, pp. 127-129, pl. viii, figs. 1, 2.
[14] Burden.—Amer. Mus. Nov., No. 316, May 18, 1928, p. 5, fig. 1.
[15] Lönnberg.—Arkiv f. Zool., XIX, häfte 4, No. 27, 1928, pp. 3-5.

who found it ten years before on Clifton Station, towards the head of King's Creek, Darling Downs, Queensland. He describes his find as follows:

"Here high in the bank I perceived the tip of jawbone with teeth thrusting out about eight feet below the grassy surface. Getting to work with pick and knife I brought out successively what remained from the bony skeleton. Never broke a single bone, found them just as you see them. Although I went for several days to the same spot, which I excavated to some extent, I was not fortunate enough to find more."

The bones found by Mr. Lau consisted of a right maxillary, left femur, right ulna, and a number of vertebræ and ribs, all belonging without doubt to one and the same individual. Of these specimens the maxillary has been described by Etheridge as cited above, vertebræ and ribs obtained from other sources have been dealt with by Owen, De Vis, and others. De Vis has also described and figured a left ulna,[16] which, allowing for the personal equation, is the same size (length 260 mm.) as the right ulna figured here (Pl. li, fig. 3). De Vis' specimen, too, was found on King's Creek, along with a number of associated bones, and may even be part of the skeleton now in this museum.

The femur (Pl. li, figs. 1, 2) is a massive and powerful bone 295 mm. (11⅝ in.) long, its greatest breadth across the proximal end 114 mm., across the distal end 105 mm.; the greatest diameter at the middle of the shaft is 47 mm., least 38·5. In general shape it bears a close resemblance to the femur of recent varanids, except that its length in proportion to breadth is considerably less. The articular surface of the head is almost rectangular in shape, and the internal trochanter is large and strongly rugose, indicating powerful pubo-ischio-femoralis muscles. The external trochanter, as in lizards generally, is small, and the trochanteric fossa is comparatively shallow. The shaft is almost straight, the dorso-ventral diameter the greater. The internal condyle of the distal end is larger than the external and the intercondylar groove, dorsal and ventral, is shallow. Above the external condyle on the ventral and postaxial surface is a crescentic sulcus, perhaps indicating the origin of the gastrocnemius muscle. The epicondyle, or outer tuberosity, for articulation with the fibula, is well developed, and the popliteal groove distinct. On the ventral (postero-inferior) aspect of the shaft an elongated area with rugose edges and extending for almost the full length of the shaft doubtless served for the insertion of the powerful adductor muscles.

Affinities.—*Megalania* has been placed by Lydekker in the genus *Varanus* as *V. priscus*;[17] Fejérváry erected for it a new

[16] De Vis.—Proc. Roy. Soc. Q'land, VI, 1889 (1890), pp. 94-96, pl. iv.
[17] Lydekker.—Brit. Mus. Cat. Foss. Rept. and Amph., Pt. I, 1888, p. 284.

family Megalanidæ of the suborder Platynota (?);[18] Camp placed in a new subfamily Megalaninæ of the family Varanidæ;[19] Dunn reverts to Lydekker's view, being disinclined to regard *Megalania* as having characters which necessitate generic much less family distinction;[20] Nopcsa places it with *Saniva* and *Thinosaurus* in the subfamily Megalaninæ of the Platynotidæ.[21]

The chief ground on which *Megalania* has been separated from *Varanus* is the supposed presence of a zygosphene and zygantrum on the vertebræ of the former. But, as Longman has pointed out,[22] Fejérváry is mistaken when he says that *Megalania* had a strongly developed zygosphene and zygantrum. At the most it had a very rudimentary zygosphene, and such is also found in *Varanus komodoensis*. On the whole, and in the light of what is so far known of the skeleton of *Megalania*, there does not seem to be sufficient grounds for its separation from *Varanus*. We may therefore agree with Dunn, who, it is interesting to note, regards *Varanus komodoensis* as "definitely an Australian type derived from an animal much like *varius* and intermediate between it and the two Australian fossil forms [*V. dirus* and *V. priscus*]."

Size.—Several estimates of the length of *Megalania* have been made. Owen, by comparing the vertebræ with those of *Varanus giganteus*, concluded that its total length would be about twenty feet.[23] Lydekker, by comparison with the vertebræ of *Varanus sivalensis* (estimated to be about twelve feet long), considered that *Megalania* was at least thirty feet long.[24] De Vis compared its humerus and scapula with those of recent varanids and assigned to it a length varying from twelve to twenty-five feet.[25] Fejérváry is more moderate, estimating its length at four and a quarter to five metres (fourteen to sixteen feet).[26] Dunn, on comparison with *V. komodoensis*, which probably approached *Megalania* in proportions more closely than any other living lizard, assigns it a length of fourteen and a half or fifteen feet.[27] I have compared the femur and ulna with those of *Varanus salvator*, *V. gouldi* and *V. varius*, the results giving lengths varying from fifteen to seventeen feet.

It is evident, however, that it was much more heavily and strongly built than any of its living relatives, and that it was comparable with a large crocodile in size and weight; indeed its vertebræ and limb bones are much more massive than those of an Estuarine Crocodile (*Crocodilus porosus*), the skeleton of which

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18 Fejérváry.—Ann. Nat. Mus. Hung., XVI, 1918, p 449
19 Camp.—Bull. Amer. Mus. Nat. Hist., XLVIII, 1923, p 321
20 Dunn.—Amer. Mus. Nov., No. 286, Sept. 30, 1927, p. 9.
21 Nopcsa.—Palaeobiologica, I, 1928, p. 177.
22 Longman.—Mem. Q'land Mus., VIII, 1924, p. 22.
23 Owen.—Phil. Trans. CXLIX, 1859 (1860), p 48.
24 Lydekker.—*Loc. cit.*, p. 284.
25 De Vis.—Proc. Roy. Soc. Q'land, II, 1885 (1886), p. 29.
26 Fejérváry.—*Loc. cit.*, p. 449.
27 Dunn.—*Loc. cit.*, p. 8.

is about fourteen feet in length, though its femur is shorter. With its formidable teeth and strongly muscled limbs it must have been a dangerous antagonist to any of its contemporaries in the Australian Pleistocene, even the bulky *Diprotodon*. The much smaller *Varanus komodoensis* is said to feed on deer, wild pigs, and water-buffalo,[28] and we may be sure that *Megalania* could deal effectively with much larger animals.

[28] Burden.—Amer. Mus. Nov., No. 316, May 18, 1928, p. 10.

CONTRIBUTIONS TO THE KNOWLEDGE OF AUSTRALIAN HEMIPTERA.

No. II.

A Revision of the Subfamily Graphosomatinæ (Family Pentatomidæ).

By

Anthony Musgrave, F.E.S.,
Entomologist, Australian Museum.

(Plates lii-liv, and one Figure.)

The members of the subfamily Graphosomatinæ are characterized by the scutellum being frequently as long as the abdomen and so broad as to leave only the basal and outer margins of the corium exposed. Kirkaldy[1] did not regard the group as worthy of subfamily status, and placed it as a tenth tribe of the subfamily Pentatominæ, the Graphosomini, and pointed out that it is "Principally characterized by the absent or very short frena, but this does not appear to be restrictive. The large scutellum is no more a character for subfamily separation than it is in *Eysarcoris* or *Discocera*." Schouteden and Distant regarded the group as worthy of subfamily rank, and in this contribution I intend to regard it as such.

I have been permitted to examine the Graphosomatid bugs in the collections of the Queensland, West Australian, and South Australian Museums, the National Museum, Melbourne, and the Macleay Museum, Sydney, through the courtesy of their directors.

Dr. Yngve Sjöstedt of the Naturhistoriska Rijksmuseum, Stockholm, has very kindly permitted illustrations to be prepared from three species identified by Stål and from four of that author's types. These drawings have been very skilfully executed by Frau Thérèse Ekblom, while to Miss Joyce K. Allan, of this Museum, I am indebted for the remainder of the illustrations. All the species of Australian Graphosomatid bugs have now been figured, with the exception of *Bolbocoris mimicus* Walker 1867, the type of which is missing from the collection of the National Museum, Melbourne, and in the future the identification of these insects should present but little difficulty to Australian entomologists.

Tribe GRAPHOSOMATARIA *Schouteden*, 1905.

Lateral angles of the pronotum not emarginate or, if they are, the antenniferous tubercles are not or hardly prominent (the head

[1] Kirkaldy.—Catalogue of the Hemiptera (Heteroptera) I. Cimicidæ, p. 34.

being viewed from above). Eyes usually not projecting, not pedunculated. Frena, when present, short, save in rare exceptions (after Schouteden).

Key to the Australian Genera.

1.	Lateral angles of pronotum prolonged into a long and broad horn	2
	Lateral angles of pronotum not prolonged into a long and broad horn ..	3
2.	Pronotal horns with 2-3 teeth; jugæ of different form in sexes	*Deroploopsis* Schouteden.
	Pronotal horns with only 1 backwardly-projecting tooth; jugæ identical in sexes	*Deroploa* Westwood.
3.	Pronotum with tubercle at base	*Eufroggattia* Goding.
	Pronotum without tubercle	4
4.	Head triangular gradually narrowed	*Numilia* Stål.
	Head not triangular	5
5.	Scutellum shorter than abdomen	*Dandinus* Distant.
	Scutellum as long as abdomen	6
6.	Head flat; pronotal angles strongly acuminate	*Testrica* Walker.
	Head convex	7
7.	Pronotal angles truncate	*Protestrica* Schouteden.
	Pronotal angles not truncated	*Propetestrica* gen. nov.

The genus *Ippatha* Distant "with no immediate ally," as its author points out, is excluded from the above key.

Genus DEROPLOOPSIS *Schouteden,* 1905.

1905. *Deroploopsis* Schouteden, Genera Insectorum, fasc. 30, p. 27. Orthotype *Deroploa curvicornis* Stål.

Distribution.—Australia.

The genus *Deroploopsis* was proposed by Schouteden in his Monograph for *Deroploa curvicornis* Stål, the structure of the head being very distinct from that of the other members of the genus *Deroploa.*

The original generic diagnosis of Schouteden is given here: "Caractères.—Tête de longeur subégale à celle du pronotum, graduellement rétrécie, les juga graduellement acuminés et divariqués, bien plus longs que le tylus, un peu recourbés et concaves légèrement en dessus, convexes en dessous; bords latéraux non sinues en avant des yeux. Pronotum à angles latéraux prolongés en une corne recourbée vers le bas et non droite comme chez *Deroploa.*"

Hitherto the female has been unknown, the type being a male. The structure of the head is quite dissimilar in the two sexes, which indicates that the suggestion of Stål, quoted by Schouteden, viz., "capite sexuum difformi?" though not applicable to the genus *Deroploa* to which it was originally applied, may now be employed for the genus *Deroploopsis* and the query omitted.

Generic diagnosis of the head of the female is as follows:

Similar to male, but jugæ not produced into acuminate processes but extend in front of tylus as flat, broad, angular lobes, the lateral margins being directed inwards towards middle line, the inner margins directed towards tylus (the angle of direction varying in the species); antennæ 5-jointed.

Key to the species of the genus *Deroploopsis* Schouteden.

1. Pronotal horns almost straight; ending in two spines 2
   Pronotal horns curved downwards; ending in three spines 3
2. Species thick set; posterior margin of pronotal horns rounded .... *Deroploopsis bidentatus* sp. nov.
   Species slender; posterior margin of pronotal horns with slight indication of third spine .... *Deroploopsis recticornis* sp. nov.
3. Species not exceeding 5 mm. in length .. *Deroploopsis curvicornis* (Stål).
   Species exceeding 5 mm. in length 4
4. Pronotal horns short .... *Deroploopsis brevicornutus* sp. nov.
   Pronotal horns not short .... *Deroploopsis trispinosus* sp. nov.

DEROPLOOPSIS CURVICORNIS (*Stål*).

(Pl. liii, fig. 7; Pl. lii, figs. 3, 4.)

1876. *Deroploa curvicornis* Stål, Svensk. Vet. Handl., xiv, n. 4, p. 32. ♂ Rockhampton, Queensland.

1905. *Deroploopsis curvicornis* Schouteden, Genera Insectorum, fasc. 30, p. 27, pl. ii, figs. 14-15.

♂. Length 4·9 mm., width across pronotal horns 3·6 mm., width at base of pronotum 2·6 mm. (Description based on specimen from Dalby, Queensland.)

Reddish-black, rugosely punctate, thickly covered with white crystal-like scales which occupy the punctures. The median longitudinal line, base of pronotum, jugæ, hemelytra, ochraceous-tawny. Colouration on under-surface variable reddish-black or flavescent.

Head 1·6 mm. across eyes, reddish-black; eyes and ocelli reddish-black; rostrum extending to middle coxæ; reddish-brown; jugæ 1·2 mm. long, the lateral margins and apices brown, not contiguous in front of tylus; tylus slightly raised.

Pronotum reddish-black in front of pronotal horns; two areas on either side of raised median line, black; area bordering posterior margin ochraceous-tawny. Pronotal horns relatively short, tridentate.

Scutellum reddish-brown; the white scales deposited in 4 rows one on each side of the curved glabrous fasciæ. (This character is depicted well in the drawing of the holotype.) Tip of scutellum black, lateral margins and glabrous ridges brownish-ochraceous. Frena very short, not extending below level of depression in anterior lateral angles of scutellum.

Hemelytra punctate, thickly covered with scales, dark brown except clavus which is black, and outer margins which are ochraceous-tawny.

Sternum reddish-brown, coarsely punctate. White crystalline scales thickly covering lateral margins of prosternum, and mesosternum and extending up the underside of pronotal horns.

Venter reddish-brown, punctate, and encrusted with white crystalline scales and with a fine pubescence.

Legs with coxæ and trochanters yellowish; acetabula, femora, tibiæ, and tarsi dark brown.

♀. Length 3·6 mm., width across pronotal horns 3·6 mm., width at base of pronotum 2·8 mm. (Description of allotype based on specimen from Dalby, Queensland. Dorsal aspect Pl. liii, fig. 7.)

Similar in colour to male. Jugæ with lateral margins widely sinuate, apices rounded; inner margins descending gradually towards tylus and contiguous before it, reddish-brown anteriorly, otherwise reddish-black.

Hab.—Queensland: Dalby, 2 ♂, 1 ♀, collected by Mrs. F. H. Hobler (South Australian Museum).

Types.—The drawings of Stål's type *Deroploa curvicornis* figured on Plate lii, figs. 3, 4, agree with the males before me. The allotype female will be preserved in the collection of the South Australian Museum.

DEROPLOOPSIS BREVICORNUTUS *sp. nov.*

(Figure 1.)

♀. Length 5·4 mm.; width across pronotal horns 5·3 mm.; width at base of pronotum 3·7 mm.

Reddish-black, rugosely punctate, with flat scales in each punctation, somewhat resembling *Deroploopsis curvicornis* (Stål) but larger, the pronotal horns more erect; median raised longitudinal line, a transverse ridge connecting light-ochraceous ridges on anterior part of pronotal horns, glabrous, ochraceous.

Head 1·8 mm. across eyes, reddish-black; eyes and ocelli black; rostrum extending to middle coxæ, reddish-brown; jugæ with lateral margins sinuate, apices rounded; inner margins rounded towards tylus and contiguous before it.

Pronotum very rugosely-punctate between pronotal horns; the raised median fascia and an irregular transverse fascia connecting the light-ochraceous ridges on the inner anterior surface of the pronotal horns, ochraceous; pronotal horns relatively short, broad,

and terminating in three teeth, two produced forwards and one backwards and outwards.

Scutellum reddish-black, rugose; the base raised in the form of a triangle due to the presence of the oblique grooves on either side running to the anterior angles; running from anterior to posterior border is a median glabrous fascia, ochraceous for two-thirds of its length, the remainder black; on either side of median

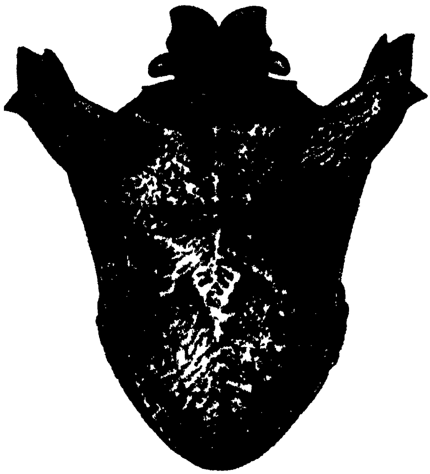

Figure 1.

fascia, but barely distinguishable from the rugose surface, are two outwardly-curved glabrous ridges ochraceous in their anterior half, and which anteriorly bridge the grooves to meet the median ridge about the apex of the raised triangular base; posteriorly they meet with the median ridge near the end of the scutellum; end of scutellum black.

Hemelytra black, punctate, thickly clothed with scales, outer margin of corium light ochraceous.

Sternum reddish-black, punctate, clothed with crystalline scales.

Venter reddish-black and covered with crystalline scales and fine hairs; flat medially, convex laterally, the anterior segments over-hanging the lateral margins.

Legs with coxæ, trochanters, and bases of femora, posterior extremities of tibiæ, and joints, yellowish, remainder reddish-black.

Hab.—S. Australia: Ooldea, 1 ♀ holotype, collected by Mr. A. M. Lea (South Australian Museum).

New South Wales: Tamworth, November, 1892, 1 ♀ paratype, collected by Mr. A. M. Lea (W. W. Froggatt collection).

DEROPLOOPSIS TRISPINOSUS *sp. nov.*

(Pl. liv, figs. 6, 7.)

♂. Length 5·5 mm.; width across pronotal horns 4·8 mm.; width at base of pronotum 2·8 mm.

Testaceous tinged with black, rugosely punctate with white crystal-like scales occupying the punctures.

Head 1·7 mm. across the eyes, reddish black; eyes and ocelli reddish-black; rostrum extending to median coxæ reddish-brown; jugæ 1·2 mm. long, not contiguous before tylus; tylus slightly raised.

Pronotum ochraceous-black in front of pronotal horns; an area on either side of median raised line, black; area bordering posterior margin, testaceous, glabrous. Pronotal horns tri-dentate.

Scutellum testaceous, rugose; raised triangular area at base reddish-black; median line and curved glabrous fasciæ on either side of it ochraceous-tawny. Tip of scutellum black. Frena very short.

Hemelytra punctate, covered with scales, ochraceous-tawny.

Sternum reddish-brown punctate with white crystalline scales in punctures; submarginally the scales thickly encrust the sternum as far as the eyes.

Venter reddish-brown, punctate, thickly encrusted at the sides with scales.

Legs for the most part reddish black, tibiæ testaceous.

♀. Length 5·5 mm., width across pronotal horns 5·5 mm., width at base of pronotum 3·5 mm. (Description based on specimen from S. Australia. Dorsal aspect Pl. liv, fig. 7.)

Similar in colour to male. Jugæ reddish-brown, with lateral margins sinuate, apices rounded; inner margins descending gradually towards tylus and contiguous before it.

Hab.—S. Australia: Port Lincoln, 1 ♂ holotype, collected by Mr. A. M. Lea (South Australian Museum); no locality, 1 ♂, 1 ♀ allotype; no locality, 1 ♂, 1 ♀ (Macleay Museum, Sydney). ? S. Australia, 1 ♂, 2 ♀.

Queensland: Dalby, 1 ♂, collected by Mrs. F. H. Hobler (South Australian Museum).

No data: 4 ♂; 7 ♀ (Macleay Museum, Sydney).

Note.—I have associated a female from another series as allotype to the male holotype from Port Lincoln, S. Australia, but I have no doubt that it represents the other sex of this species. The males vary somewhat in size, the Dalby, Queensland, specimen being 6·5 mm. from the end of the scutellum to the tips of the jugæ, and some of the old specimens in the collection of the Macleay Museum are darker in colour than the localized specimens in the South Australian Museum. The females, on the other hand, show but slight variation in size, but a female in the Macleay Museum Collection has the area between the pronotal horns which is normally rugose and glabrous, raised into a broad glabrous area, in which are large punctures, owing to the ridges becoming fused into an irregular plate. The median line and the transverse ridge bordering the anterior margin of the pronotum are distinctly swollen.

Types.—The holotype ♂ and paratype ♂ are preserved in the S. Australian Museum collection, the allotype ♀ in the Macleay Museum, Sydney, together with a series of 4 ♂ and 8 ♀ paratypes, while a series of 3 ♂, 3 ♀ are retained in this Museum.

Deroploopsis recticornis *sp. nov.*

(Pl. liii, figs. 1-4.)

♂. Length 6·3 mm.; width across the pronotal horns 5·3 mm.; width at base of pronotum 3 mm. (Dorsal aspect, Pl. liii, fig. 1; ventral aspect, Pl. liii, fig. 2; head and pronotum, lateral aspect, Pl. liii, fig. 3.)

Black, rugosely punctate, each puncture containing a white crystalline scale. A median longitudinal line running from the fore-border of the pronotum to the end of the scutellum, and four spots in the centre of pronotum, ochraceous-tawny. Other ochraceous-tawny marks present along the margins of scutellum and pronotum. Legs for the most part ochraceous-tawny.

Head 1·7 mm. across the eyes, black; eyes reddish-black and projecting for about two-thirds of their width beyond the lateral margins, ocelli black; rostrum extending to anterior coxæ, reddish-brown; finely pubescent; antennæ ochraceous-tawny with fine white pubescence; jugæ ochraceous-tawny, their lateral margins and apices brown; tylus slightly raised with a reddish-black spot in the centre.

Pronotum black, rugosely punctate; four glabrous areas near bases of pronotal horns, ochraceous-tawny; pronotal horns 2·5 mm. long; each horn bi-dentate, and with a suggestion of a third on the posterior margin.

Scutellum with a concavity at each anterior lateral angle. Lateral margins, median longitudinal line extending the length of

the scutellum, the two curved fasciæ on either side, but which do not reach to the anterior or posterior borders, ochraceous-tawny and glabrous. Apex black.

Hemelytra punctate, black near scutellum and pronotal borders, otherwise ochraceous.

Sternum shining black, not as coarsely punctate as upper surface.

Venter shining black, reddish-black at the lateral margins, with very fine pubescence. Last abdominal segment rounded, rugose, bearing fine hairs and crystal-like bodies.

Legs with the coxæ, trochanters, apices of femora, distal two-thirds of tibiae, tarsi and proximal end of tarsal claws ochraceous-tawny, otherwise black; fine white pubescence is present chiefly towards apices of tibiæ and first joint of tarsus.

♀. Length 5·4 mm.; width across pronotal horns 5·3 mm.; width at base of pronotum 3·1 mm. (Head and pronotum, Pl. liii, fig. 4.)

Similar in colour to male. Lateral margins of jugæ almost straight, inner margins descending sharply towards tylus but not contiguous. Jugæ ochraceous tawny anteriorly, darker posteriorly. Genital plates rugose, covered with flat-scale or crystal-like structures.

Hab.—W. Australia: ? Geraldton, September, 1926, 1 ♂, holotype, collected by Mr. H. J. Carter (Australian Museum); Cunderdin, Sept.-Oct., 1913, 1 ♀, allotype (West Australian Museum).

DEROPLOOPSIS BIDENTATUS *sp. nov.*

(Pl. liii, figs. 5, 6.)

♂. Length 6·2 mm.; width across pronotal horns 5·6 mm.; width at base of pronotum 3·7 mm. (Dorsal aspect, Pl. liii, fig. 5.)

Similar in general appearance to *D. recticornis* mihi, but lighter in colour and more robust. Head, pronotal horns, anterior and posterior margins of scutellum black-punctate, each puncture containing a white flattened crystal-like structure. A raised median longitudinal line extending from fore-border of pronotum to end of scutellum, light yellow. A mark extending between the bases of the pronotal horns, and three areas further back near the posterior margin of pronotum, light yellow. Jugæ yellow. Ridges on underside of pronotal horns, light yellow. Legs brownish-yellow. Ventral surface of abdomen brownish-black.

Head 1·8 mm. across the eyes, black; eyes and ocelli reddish-black; rostrum extending to middle coxæ, reddish-brown, finely

pubescent; antennæ ochraceous with fine white pubescence; each juga shaped like an isosceles triangle, the outer margin slightly concave; jugæ baso-dorsally concave, lateral margins and apices brown, sparsely covered with white scales, otherwise yellow; tylus slightly raised.

Pronotum with greater part of pronotal horns and pronotal callosities black; four irregular bands extending to anterior margin of scutellum, two from the bases of pronotal horns and two from blotches behind pronotal callosities, reddish-black; otherwise light-yellow; pronotal horns bi-dentate, posterior margin curving gently to apex.

Scutellum with fore-margin, except in centre, and hind margin, black; lateral margins, median longitudinal line, two broad irregular fasciæ on either side of it but not reaching anterior or posterior margins, light-yellow and glabrous; otherwise reddish-black.

Hemelytra strongly punctate, clavus reddish-black, corium reddish-black near scutellum; otherwise light yellow.

Sternum black.

Venter brownish-yellow towards lateral margins, otherwise brownish-black. Last abdominal segment black, rugose.

Legs coxæ and trochanters light yellow; acetabula, femora, tibiæ, and tarsi brownish-yellow.

♀. Length 5·6 mm.; width across pronotal horns 5·5 mm.; width at base of pronotum 3·7 mm. (Dorsal aspect of head and pronotum, Pl. liii, fig. 6.)

Similar in colour to male. Jugæ with lateral margins widely sinuate; apices rounded; inner margins descending gently towards the tylus and contiguous before it, anteriorly ochraceous-tawny, otherwise as in male. Under-surface of body thickly covered with white scale-like structures.

Hab.—S. Australia: Parachilna, Flinders Range, 3 ♂, 6 ♀, collected by Mr. E. L. Savage (South Australian Museum).

Victoria: Kewell, 28th October, 1889, 2 ♀, collected by Mr. J. Hill.

Types.—Holotype ♂ and allotype ♀, and 1 ♂, 4 ♀ paratypes, in South Australian Museum collection; 1 ♂, 3 ♀ paratypes in collection of Australian Museum.

Genus DEROPLOA *Westwood*, 1835.

1835. *Deroploa* Westwood, Zool. Journ., v, p. 445. Haplotype *Deroploa parva* Westwood.

1905. *Deroploa* Schouteden, Genera Insectorum, fasc. 30, p. 27.

Distribution.—Australia.

DEROPLOA PARVA *Westwood.*

1835. *Deroploa parva* Westwood, Zool. Journ., v, p. 445, pl. xxii, fig. 6. New Holland.

1839. *Deroploa parva* Germar, Zeitschr. Ent., i, p. 68.

1843. *Deroploa parva* Amyot and Serville, Hist. Nat. Insectes Hemipt., p. 58. Tasmania; New Holland.

1851. *Deroploa parva* Dallas, List. Hemipt. B.M., i, p. 54. New Holland.

1867. *Deroploa parva* Walker, Cat. Hemipt. Heter. B.M., i, p. 74. New Holland.

1876. *Deroploa parva* Stal, Kongl. Sv. Vet. Akad. Hand., xiv, n. 14, p. 32. N. Australia.

1905. *Deroploa affinis* Schouteden, Ann. Soc. Ent. Belg., xlix, p. 143. Victoria.

1905. *Deroploa affinis* Schouteden, Genera Insectorum, fasc. 30, p. 27, pl. 2, fig. 5.

Hab.—Queensland: National Park, 23rd and 24th October, 1923, 2 ♀, collected by Mr. H. Hacker (Queensland Museum).

New South Wales: Tooloom, January, 1926, 2 ♀, collected by Mr. H. Hacker; Armidale, October, 1892, 1 ♀, collected by Mr. A. M. Lea (Froggatt Collection); Rope's Creek, 1 ♀ (Macleay Museum); Gosford, 2 ♀, collected by Mr. H. J. Carter (Macleay Museum); Bodalla, November, 1925, 1 ♀, collected by Mr. H. J. Carter (Australian Museum); Hornsby, 1 ♀, collected by Mr. C. Gibbons.

Victoria: Caulfield, 1 ♀; Woori-Yallock, 2nd March, 1924, 2 ♂, collected by Mr. J. E. Dixon; Fern Tree Gully, 14th April, 1912, 1 ♀; Healesville, 8th May, 1915, 1 ♀; Wandong, 7th November, 1905, 1 ♀, collected by Mr. F. Spry. (All Victorian specimens from the National Museum, Melbourne).

Note.—China[2] has stated that a specimen from the National Museum, Melbourne, examined by him, and labelled "Eufroggattia, Goding," proves to be *Deroploa affinis* Schouteden. The fifteen specimens of *Deroploa* before me agree with Schouteden's figure in the Genera Insectorum, except that in some the yellow callosity running transversely across the pronotum is barely visible. Specimens labelled *Eufroggattia tuberculata* from Wandong, Fern Tree Gully, and Healesville, Victoria, have been sent to me from the National Museum, Melbourne, and they agree in every respect with a single specimen correctly labelled *Deroploa parva,* from Caulfield, forwarded from the same institution. As Westwood's name is the

[2] China.—Ann. Mag. Nat. Hist., (9) xx, p. 279, 1927.

earlier one, and as there do not appear to be sufficient grounds to warrant the separation of the two species, I here place *D. affinis* Schouteden as a synonym of *D. parva* Westwood.

The species appears to be common in eastern Australia.

Genus EUFROGGATTIA Goding, 1903.

1903. *Eufroggattia* Goding, Proc. Linn. Soc. N. S. Wales, xxviii, p. 37. Orthotype: *Eufroggattia tuberculata* Goding (Family Membracidæ).

1912. *Paraderoploa* Schouteden, Ann. Soc. Ent. Belg., lvi, p. 354. Orthotype: *Deroploa* (*Paraderoploa*) *perkinsi* Schouteden.

1927. *Eufroggattia* China, Ann. Mag. Nat. Hist., (9) xx, p. 279. (Transferred from Membracidæ to Pentatomidæ.)

Distribution.—Australia.

EUFROGGATTIA TUBERCULATA *Goding.*

(Pl. liii, figs. 8, 9.)

1903. *Eufroggattia tuberculata* Goding, Proc. Linn. Soc. N. S. Wales, xxviii, p. 38, pl. i, figs. 17-19. Wingham, N. S. Wales.

1912. *Deroploa* (*Paraderoploa*) *perkinsi* Schouteden, Ann. Soc. Ent. Belg., lvi, p. 354. C. Queensland.

1927. *Eufroggattia tuberculata* China, Ann. Mag. Nat. Hist., (9) xx, p. 280.

Hab.—Queensland: Brisbane, 18th and 24th July, 1926, 2 ♂, 2 ♀, on *Acacia* flowers, collected by Mr. H. Hacker (Queensland and Australian Museums); Brisbane, 8th April, and 20th May, 1906, 2 ♀ (W. W. Froggatt collection).

Note.—This species was placed by Dr. Goding in the Membracidæ, but China (*supra*) has shown that it is a Graphosomatid bug, and that *Deroploa* (*Paraderoploa*) *perkinsi* Schouteden is a synonym of it. There appears to be some confusion in Australian museums as to the identity of this species, for from both the Queensland and National Museums I received specimens of *Deroploa parva* Westwood labelled as *Eufroggattia tuberculata* Goding, though the former institution also contained specimens of the latter species correctly identified. The fact that this insect was not a Membracid has been overlooked by Australian entomologists, though Froggatt in his "Australian Insects," p. 358, says in his description of the Membracidæ, "*Eufroggattia tuberculata* is a rare insect usually found resting on a twig of a eucalyptus sapling, and is shaped very much like some of the small plant bugs belonging to the Genus *Testrica*; it is short and broad in form, with the head exposed; the thorax has short blunt horns; and the abdomen is broadly rounded at the apex."

The species is easily identified by the presence of the tubercle at the base of the scutellum and the very short pronotal horns.

The figure given by Goding is very poor, so that dorsal and lateral views of the insect are here given and are taken from a specimen collected by Mr. H. Hacker at Brisbane.

Genus DANDINUS *Distant*, 1904.

1904. *Dandinus* Distant, Ann. Mag. Nat. Hist., (7) xiii, p. 264. Orthotype: *Dandinus crassus* Distant.

1905. *Testricoides* Schouteden, Ann. Soc. Ent. Belg., xlix, p. 144. Orthotype: *Testricoides pulcherrimus* Schouteden.

1905. *Testricoides* Schouteden, Genera Insectorum, fasc. 30, p. 26.

1910. *Dandinus* Distant, Ann. Mag. Nat. Hist., (8) vi, p. 371.

Some difference of opinion has existed as to the correct status of this genus and the subfamily in which it should be placed, though Distant in his description states that the genus "may be placed near the Ethiopian genus *Æschrus* Spin." which is included in the subfamily Pentatominæ by Kirkaldy. Schouteden, on the other hand, places his *Testricoides*, which Distant has shown to be a synonym of *Dandinus*, in the Graphosomatinæ.

Distribution.—Australia.

DANDINUS CRASSUS *Distant*.

1904. *Dandinus crassus* Distant, Ann. Mag. Nat. Hist., (7) xiii, p. 264. Townsville, N. Queensland.

1905. *Testricoides pulcherrimus* Schouteden, Ann. Soc. Ent. Belg., xlix, p. 144. Victoria.

1905. *Testricoides pulcherrimus* Schouteden, Genera Insectorum, fasc. 30, p. 26, pl. 2, f. 8.

1910. *Dandinus crassus* Distant, Ann. Mag. Nat. Hist., (8) vi, p. 372.

Hab.—Victoria: Mallee, 1915, 1 ♂, 1 ♀, collected by Mr. J. E. Dixon and which bear a label "det. B. Uvarov" (National Museum).

Queensland: Dalby, 1 ♀, collected by Mrs. F. H. Hobler (S. Australian Museum).

New South Wales: Dorrigo, 1 ♀, collected by Mr. W. Heron (S. Australian Museum).

Genus NUMILIA Stål, 1867.

1867. *Numilia* Stål, Öfv. Vet.-Akad. Förh., p. 503. (No species.)

1869. *Numilia* Stål, Berl. Ent. Zeitschr., xiii, p. 225. Logotype: *Numilia subquadrata* Stål.

1876. *Numilia* Stål, Svensk. Vet. Handl., xiv, 4, p. 33.

1905. *Numilia* Schouteden, Genera Insectorum, fasc. 30, p. 24.

Distribution.—Australia.

NUMILIA SUBQUADRATA *Stål.*

1869. *Numilia subquadrata* Stål, Berl. Ent. Zeitschr., xiii, p. 225. ♀, N. Australia.

1905. *Numilia subquadrata* Schouteden, Genera Insectorum, fasc. 30, p. 24, pl. 2, f. 7.

Note.—This species is autoptically unknown to me.

Genus TESTRICA *Walker,* 1867.

1867. *Testrica* Walker, Cat. Hemipt. Heter. B.M., 1, p. 69. Haplotype: *Testrica antica* Walker.

1876. *Testrica* Stål, Svensk. Vet. Handl., xiv, 4, p. 29 and p. 32.

1905. *Testrica* Schouteden, Genera Insectorum, fasc. 30, p. 244.

Head nearly flat above or even lightly concave in front; jugæ contiguous before the tylus. *Pronotum* with lateral angles strongly acuminate, produced outwards; without clear transverse impression. *Scutellum* without clear impressions. *Venter* with sides slightly convex. Body not strongly punctate.

Distribution.—Australia.

Key to the species of the genus *Testrica* Walker.

1. Lateral angles of pronotum short, not produced forwards . . . . *T. antica* Walker.
   Lateral angles of pronotum long, produced forwards 2
2. Lateral angles slender; spines at anterior lateral angles of pronotum, short . . . . *T. bubala* Stål.
   Lateral angles broader and turned inwards; spines at anterior lateral angles of pronotum, long . . . . *T. hœdulea* Stål.

TESTRICA ANTICA *Walker.*

(Pl. liii, fig. 12; Pl. lii, figs. 5, 6.)

1867. *Testrica antica* Walker, Cat. Hemipt. Heter. B.M., i, p. 70. Adelaide, S. Australia.

1876. *Testrica antica* Stål, Svensk. Vet. Handl., xiv, 4, p. 32. Adelaide, S. Australia.

Hab.—S. Australia: Mt. Lofty, 4 ♂, 5 ♀; Murray Bridge, 1 ♂; Magill, 19th Oct., 1883, 2 ♂, 3 ♀ on Hibbertia shrubs, *Eucalyptus obliqua,* and blooming shrubs, all collected by Mr. J. G. O. Tepper; Ooldea, 4 ♂, 6 ♀ collected by Mr. A. M. Lea (S. Australian Museum).

Victoria: Marysville, 2 ♀ (National Museum).

N. S. Wales: Pillaga, 3 ♀ (W. W. Froggatt collection); 1 ♀, ? locality (Dept. Agriculture, N. S. Wales); 1 ♀, ? locality (Macleay Museum).

Note.—The specimen identified as *Testrica antica* by Stål in 1876 is figured here by Frau Thérèse Ekblom, and a drawing of a female specimen from Mt. Lofty, S. Australia, in the collection of the South Australian Museum, prepared for me by Miss Joyce K. Allan before the drawings of Stål's species came to hand, is also included.

Testrica hædulea *Stål.*

(Pl. lii, figs. 9, 10.)

1876. *Testrica hædulea* Stål, Svensk. Vet. Handl., xiv, 4, p. 32. ♀, W. Australia.

1905. *Testrica hædulea* Schouteden, Genera Insectorum, fasc. 30, p. 26, pl. 2, f. 6.

Hab.—W. Australia: King George's Sound, 1 ♀ (Macleay Museum).

Note.—The jugæ in the specimen from King George's Sound are not contiguous before the tylus.

The figures I give here have been drawn from Stål's type.

Testrica bubala *Stål.*

(Pl. lii, figs. 13, 14.)

1876. *Testrica bubala* Stål, Svensk. Vet. Handl., xiv, 4, p. 32. ♀, N. Australia.

Hab.—S. Australia: 2 ♀ (Macleay Museum); Belair, 24th Nov., 1883, 1 ♂ on Eucalypts; Murray Bridge, 16th Jan., 1886, 1 ♀; same loc., 14th Jan., 1889, 1 ♀; Mt. Lofty, 1 ♀, all collected by Mr. J. G. O. Tepper; Murray Bridge, 4 ♀; Murray River, 1 ♀, collected by M. H. S. Cope (S. Australian Museum).

Victoria: Glenrowan, 1 ♀ bearing a label "*Testrica hædulea* Stål, det. B. Uvarov" (National Museum); Bendigo, 2 ♂, 2 ♀ (F. E. Wilson collection).

N. S. Wales: Hornsby, 1 ♀, collected by Mr. C. Gibbons (Australian Museum).

W. Australia: King George's Sound, 1 ♀ (Macleay Museum).

? locality, 1 ♀ identified by Francis Walker as *Testrica antica* (National Museum); ? locality, 4 ♀ (Macleay Museum).

Note.—The figures given here have been prepared from Stål's type.

TESTRICA MIMICA (*Walker*).

1867. *Bolbocoris mimicus* Walker, Cat. Hemipt. Heter. B.M., i, p. 63. Queensland: Type in National Museum, Melbourne.

1905. ? *Testrica mimica* Schouteden, Genera Insectorum, fasc. 30, p. 26.

Note.—Type missing.

Genus PROTESTRICA *Schouteden*, 1905.

1905. *Protestrica* Schouteden, Genera Insectorum, fasc. 30, p. 24. Logotype: *Testrica rudis* Germar 1839, selected by Kirkaldy, 1909.

1909. *Protestrica* Kirkaldy, Cat. Hemipt. Heteropt., p. xxxiii and p. 227.

Head, including jugæ and tylus, moderately (but clearly) convex; jugæ not contiguous before tylus, gaping. *Pronotum* with lateral angles not, or hardly, prominent, truncated, and sinuated; a weak transverse impression about middle of pronotum. *Scutellum* with clear impressions on each side near its base. *Venter* with sides convex. Body strongly punctate.

Distribution.—Australia.

Key to the species of the genus *Protestrica* Schouteden.

1. Scutellum not reaching the end of the abdomen. Lateral angles of pronotum not furrowed. Anterior angles of pronotum armed with prominent spines .... *T. subpunctatus* Walker.
   Scutellum reaching the end of the abdomen. Lateral angles of pronotum deeply furrowed at base. Anterior angles of pronotum armed with short spines 2
2. Lateral angles of pronotum rounded; head emarginate .. *T. rudis* Germar.
   Lateral angles of pronotum not rounded; head not emarginate .... *T. stali* Schouteden.

PROTESTRICA RUDIS (*Germar*).

(Pl. lii, figs. 1, 2.)

1839. *Podops rudis* Germar, Zeitschr. Ent., i, p. 66, 7. S. Australia.

1851. *Id.* Dallas, List Hemipt. Ins. B.M., p. 54, 9. New Holland.

1867. *Id.* Walker, Cat. Hemipt. Heteropt. B.M., i, p. 73. Australia.

1868. *Bolbocoris emarginatus* Vollenhoven, Versl. Ak. Nat. Amsterd., (2) ii, p. 177. New Holland.

1876. *Testrica rudis* Stål, Kongl. Sv. Vet. Akad. Handl., xiv, n. 4, p. 32. Adelaide, S. Australia.

1905. *Testrica rudis* van Duzee, Bull. Am. Mus. Nat. Hist., xxi, p. 190. N. S. Wales.

1906. *Testrica rudis* Kirkaldy, Proc. Linn. Soc. N. S. Wales, xxxii, p. 769. Sydney, N. S. Wales.

Hab.—S. Australia: Mt. Lofty, 8 ♂, 4 ♀, and Burnside, 5th July, 1884, 1 ♀ collected by Mr. J. G. O. Tepper; Adelaide, 1 ♂, 3 ♀, collected by Mr. A. M. Lea (S. Australian Museum).

Victoria: Lake Hattah, 2nd Sept., 1924, 3 ♂, 4 ♀, collected by Mr J. E. Dixon; Glenrowan, 2 ♀ (National Museum).

Note—The specimen identified as *Testrica rudis* by Stål in 1876 is figured here.

PROTESTRICA STALI (*Schouteden*).

(Pl. lii, figs. 11, 12.)

1876. *Testrica emarginata* Stål, Kongl. Sv. Vet. Akad. Handl., xiv, n. 4, p. 32. ♂, ♀. N. Australia. Name preoccupied by *Testrica* (*Protestrica*) *emarginata* (Vollenhoven) 1868 [*Bolbocoris*].

1905. *Testrica stali* Schouteden, Genera Insectorum, fasc. 30, p. 26. New name.

Hab.—N. S. Wales: Sydney, 1 ♀, and Hornsby, 4 ♂, all collected by Mr. C. Gibbons (Australian Museum).

Victoria: Quantong, 3rd April, 1928, 3 ♂, collected by Mr. A. D. Selby (F. E. Wilson collection); ? Warburton, 14th Jan., 1918, 2 ♀ collected by Mr. R. J. Kelly (National Museum); Gunbower, 2 ♀ (National Museum); Geelong, 1 ♂, collected by Mr. H. W. Davey (S. Australian Museum).

Tasmania: Launceston, 1 ♂, collected by Mr. F. M. Littler; ? locality, 1 ♀, collected by Mr. A. Simson (S. Australian Museum).

Note.—The figures given here are based on Stål's type, *Testrica emarginata*.

PROTESTRICA SUBPUNCTATA (*Walker*).

(Pl. liii, fig. 11.)

1867. *Bolbocoris subpunctatus* Walker, Cat. Hemipt. Heter. B.M., i, p. 63. Queensland: Type in National Museum, Melbourne.

1906. *Testrica distincta* Schouteden, Ann. Soc. Ent. Belg., l, p. 138. No locality given.

Hab.—Queensland: ? sex, holotype (National Museum).

New South Wales: Clarence River, 1 ♀, collected by A. and F. R. Zeitz (S. Australian Museum); Upper Williams River, Oct., 1926, 1 ♂, collected by Messrs. A. M. Lea and F. E. Wilson; Brook-

lana, E. Dorrigo, 7 ♂, 9 ♀, collected by Mr. W. Heron (Australian Museum).

Note.—The specimen in the National Museum, Melbourne, labelled *Bolbocoris subpunctatus* in Walker's handwriting, agrees with his description and may be regarded therefore as the type. The specimen, however, is badly damaged, and lacks the abdomen and the greater part of the scutellum. In Walker's description the locality is given as Queensland, but no locality label is attached to the type. A female specimen, however, in the South Australian Museum from the Clarence River, New South Wales, agrees in structure with the type, except that "the longitudinal abbreviated and interrupted pale yellow line" on the thorax, and the "three pale yellow points on the fore border" of the scutellum, are duller. Walker gives the length of the body as 2 lines, but the length of the type from the front of the head to the tips of the wings measures 6·5 mm. or 3¼ lines. The Clarence River specimen measures 6·4 mm. from the front of the head to the end of the abdomen or 6·5 mm. to the tips of the wings. The figure given has been drawn from the holotype.

Genus PROPETESTRICA *nov.*

Head including jugæ and tylus convex; jugæ contiguous before tylus. *Pronotum* with lateral angles but slightly prominent; weak transverse impression about the middle. *Scutellum* with impressions near base clearly defined (as in *P. angulata* mihi) or barely recognizable (as in *P. trimaculata* mihi). *Venter* with sides convex. Body strongly convex. *Sternum* sulcated.

The genus appears to constitute a link between *Testrica* Walker and *Protestrica* Schouteden, with strong affinities towards the latter.

Genotype.—*P. trimaculata*, sp. nov.

PROPETESTRICA TRIMACULATA *sp. nov.*

(Pl. liv, figs. 1, 2.)

♀. Length 6·2 mm.; width across pronotal angles 4 mm.

Brownish-ochraceous, darkly punctate, posterior part of pronotum, apical two thirds of scutellum, and three spots at base of scutellum, ochraceous.

Head rugosely punctate, black; width across eyes 2 mm., eyes and ocelli reddish-brown; jugæ and a spot at base of tylus reddish; rostrum extending to posterior coxæ, brownish black; antennæ with the three basal segments ochraceous, two terminal segments black.

Pronotum rugosely and darkly punctate, anterior half much darker than posterior half which is ochraceous; a raised glabrous fascia extending from middle of anterior border to beyond centre of

pronotum and ending in a glabrous spot, ochraceous; a glabrous spot situated at the posterior lateral extremity of each pronotal fovea, ochraceous; anterior angles armed with short blunt spines, ochraceous; lateral margins straight and terminating posteriorly in a flange or slight prominence which overhangs the rounded angles, brownish-ochraceous; posterior margin black.

Scutellum convex, not reaching to the end of the abdomen, rugosely punctate, punctures black, the area between the punctures light-yellow or ochraceous; brownish-black on the raised basal part with three raised glabrous yellowish spots along basal margin, two overhanging basal depressions and one situated medially; frena short and extending slightly below level of basal depressions.

Hemelytra with clavus dark-brown, corium ochraceous with coarse black punctures, posterior margin brownish-black; membrane hyaline clouded with brown, nervures brown.

Sternum coarsely punctate, each puncture brownish and sometimes with a flattened crystal scale; area between punctures brownish-ochraceous.

Venter medially and along margin of segments, dark brown, glabrous, otherwise ochraceous suffused with brown.

Legs, coxæ, trochanters, light-ochraceous; femora, tibiæ, and tarsi brownish-black with spots near tibial end of femora, extremities of femora and tibiæ, and median annulations on tibiæ, reddish-ochraceous.

♂. Length 6·2 mm.; width across pronotal angles 4 mm.

Similar in coloration to female.

Hab.—Victoria: Lake Hattah, December, 1919, 3 ♂, 1 ♀, December 6, 1923, 2 ♀, collected by Mr. J. E. Dixon (National Museum, Melbourne).

S. Australia: Nuriootpa, 2 ♀, collected by Mr. J. G. O. Tepper (S. Australian Museum).

Types.—Holotype ♀, allotype ♂, and paratype ♀ in National Museum, Melbourne, and other paratype material in Australian and South Australian Museums.

PROPETESTRICA ANGULATA *sp. nov.*

(Pl. liv, figs. 9, 10.)

♂. Length 4·7 mm.; width across pronotal angles 3 mm.

Somewhat similar in general appearance to *Propetestrica trimaculata* mihi, but less convex and the pronotal angles are more pronounced, the median fascia extends from the anterior pronotal

margin to about the middle of the scutellum, but about the middle of the pronotum it expands into a glabrous arrowhead-shaped spot situated in a slight depression. The three spots at base of scutellum are less pronounced, and the two oblique depressions at the base of the scutellum are very clearly defined as in *Protestrica*.

Head rugosely punctate, reddish-black; width across eyes 1·5 mm., eyes and ocelli reddish-brown; raised parts of jugæ and tylus and margins of jugæ reddish-ochraceous; rostrum extending to middle coxæ, reddish-ochraceous; antennae with first three segments ochraceous, two terminal segments reddish-black.

Pronotum reddish-black in front of pronotal angles, rugosely punctate, posterior half yellowish-ochraceous with coarse black punctures arranged in irregular transverse rows; median fascia and arrowhead-shaped spot glabrous, yellowish-ochraceous; anterior angles armed with pointed spines, ochraceous; lateral angles somewhat sinuate anteriorly, posteriorly they project outwards over the angles which are somewhat truncated, descending abruptly to the posterior margin.

Scutellum only slightly convex, reaching almost to the end of the abdomen, rugosely punctate, punctures black, otherwise yellowish-ochraceous; basal margin black, with three glabrous spots, yellowish-ochraceous, from the median there extends posteriorly to about the middle of the scutellum a fascia which extends along the ridge between the two oblique depressions; frena very short.

Hemelytra with corium and clavus yellowish-ochraceous and coarsely punctured with brownish-ochraceous; membrane hyaline.

Sternum black, punctate, hind margins of pro-, meso-, and metasternum, ochraceous.

Venter punctate, medially and along margins of segments and lateral margins, black; genital plate punctate, broadly black along anterior margin, otherwise reddish-ochraceous.

Legs very similar to those of *P. trimaculata* mihi, ochraceous annulated with black.

♀. Length 5 mm.; width across pronotal angles 3·5 mm.

The allotype is much darker than the holotype, but a paratype female from Cooper's Creek is even lighter in colour than the male.

Hab.—S. Australia: Ooldea, 1 ♂, collected by Mr. A. M. Lea; Karoonda to Peebinga, 1 ♀, collected by Mr. G. E. H. Wright; Cooper's Creek, Central Australia, 1916, 1 ♀, collected by S. Australian Museum Expedition (South Australian Museum).

Types.—Holotype ♂ and allotype ♀ in South Australian Museum, paratype ♀ in Australian Museum.

Genus IPPATHA *Distant,* 1910.

1910. *Ippatha* Distant, Ann. Mag. Nat. Hist., (8) vi, Oct., p. 370. *Ippatha australiensis* Distant.

Distribution.—Australia.

Key to the species of the genus *Ippatha* Distant.

1. Species exceeding 7 mm. in length; ventral sublateral ochraceous fasciæ extending from head to end of abdomen .... *Ippatha australiensis* Distant.
   Species rarely exceeding 7 mm. in length; ventral sublateral ochraceous fasciæ not extending from head to end of abdomen 2
2. Ochraceous fasciæ broad; ventral sublateral ochraceous fasciæ extending from prosternum to end of abdomen .... *Ippatha ornata* Distant.
   Ochraceous fasciæ narrow; ventral sublateral fasciæ extending only the length of the abdomen .... *Ippatha angustilineata* sp. nov.

IPPATHA AUSTRALIENSIS *Distant.*

(Pl. liii, figs. 13, 14.)

1910. *Ippatha australiensis* Distant, Ann. Mag. Nat. Hist., (8) vi, Oct., p. 370. Alexandria and Hermannsberg, N. Australia.

Hab.—N. Territory, 1 ♀ (Australian Museum); N. W. Australia, 2 ♂ (Macleay Museum).

IPPATHA ORNATA *Distant.*

(Pl. liv, fig. 8.)

1910. *Ippatha ornata* Distant, Ann. Mag. Nat. Hist., (8) vi, Oct., p. 371. Peak Downs, Q.

Hab.—N. W. Australia: 1 ♀ (Macleay Museum).

IPPATHA ANGUSTILINEATA *sp. nov.*

(Pl. liv, figs. 4, 5.)

♀. Length 5·6 mm.; width across pronotum 2·9 mm.

Head 2·7 mm. across eyes, black, shining, rugosely punctate; eyes black, ocelli reddish; rostrum extending to middle coxæ, reddish-brown; jugæ contiguous before tylus; anterior margins of head pale ochraceous, glabrous.

Pronotum black, rugosely punctate, with a central transverse pale ochraceous fascia with a brick-red spot in the centre; anterior margin bordered with a glabrous, pale ochraceous fascia terminating just before lateral margins; lateral margins overhanging prosternum, glabrous, pale ochraceous, and with brick-red areas about the centre of each pale ochraceous mark; posterior margin slightly recurved with a concave, pale ochraceous fascia situated immediately in front of it.

Scutellum black, rugosely punctate, not reaching to end of abdomen, with three longitudinal glabrous, pale ochraceous fasciæ, two lateral, one central, extending from anterior margin almost to end of scutellum with brick-red areas towards their anterior extremities, the central fascia tinged with brick-red for the greater part of its length.

Hemelytra punctate, reddish-black; clavus with a pale ochraceous stripe, corium with outer and inner margins ochraceous.

Sternum black, shining; prosternum with two pale ochraceous fasciæ on the anterior margin, one on each side of the sternal sulcus.

Venter black, punctate laterally, glabrous and shining towards the middle; two glabrous, pale ochraceous fasciæ situated sub-laterally extend longitudinally from the anterior margin to anal segment; lateral margins pale ochraceous with brick-red areas towards the posterior margins of each segment.

Legs black, anterior femora swollen, anterior tibiæ with an ochraceous band towards the outer angle; other legs missing.

Hab.—Ooldea, S. Australia, 1 ♀, collected by Mr. A. M. Lea. (Holotype in South Australian Museum.)

Tribe PODOPARIA *Stal*, 1872.

Lateral angles of pronotum emarginate terminating in front in a tooth more or less clear (in reality the angle is entire, but the antero-lateral border of the pronotum continues in a tooth before it, which gives the appearance in question); antenniferous tubercles visible wholly or to a great extent from above, acuminate more often outside. Eyes prominent, pedunculated. Frena present, occupying almost a third of the length of the scutellum (after Schouteden).

Key to the Australian genera.

Jugæ longer than tylus; pronotum with a deep transverse impression .... *Coracanthella* gen. nov.
Jugæ not longer than tylus; pronotum without a deep transverse impression. .... *Scotinophara* Stål.

Genus CORACANTHELLA *nov.*

Body ovate, coarsely punctate, pilose.

Head with tylus convex, and jugæ flattened and projecting beyond tylus, their apices separated; antennæ short, basal segment visible from above, antenniferous tubercles each forming a small inwardly-curved spine; rostrum reaching hind coxæ. *Pronotum* twice as broad as long, with a median deep transverse impression,

the area in front being slightly raised, the pronotal callosities forming rugose elevations; lateral margins each provided with a long broad spine near anterior angles, a sharp tooth near posterior angle, the border between the two convex. *Scutellum* long, almost reaching the tip of abdomen, narrowed behind base. Frena short about ¼ the length of scutellum. *Venter* convex, apical angles of segments prominent and tuberculated.

Apparently allied to the Indo-Malayan genus *Storthecoris* Horvath, 1883.

Genotype.—*Scutellera geophila* Montrouzier.

Distribution.—Australia and New Caledonia.

CORACANTHELLA GEOPHILA (*Montrouzier*).
(Pl. lii, figs. 7, 8; Pl. liii, fig. 10.)

1858. *Scutellera geophila* Montrouzier, Ann. Soc. Linn. Lyon., v, p. 243 (*fide* Kirkaldy, Cat. Hemipt. (Heterop.) I. Cimicidæ, p. 235, 1909).

1861. *Podops geophila* Montrouzier, Ann. Soc. Ent. France, p. 61. New Caledonia and New Holland.

1867. *Podops teter* Walker, Cat. Hemipt. Heter. B.M., i, p. 74. Queensland. In the National Museum at Melbourne.

1876. *Scotinophara geophila* Stål, Kongl. Sv. Vet. Akad. Handl., xiv, n. 4, p. 33. N. Australia.

1914. *Scotinophara geophila* Distant, Nova Caledonia, i, livr. iv, n. 10, p. 371. Coné, New Caledonia.

Montrouzier's 1858 diagnosis is not available to me, but I have consulted his 1861 description and it applies to the material examined. The holotype male of *Podops teter* Walker is in the National Museum, Melbourne, in a bad state of preservation, and bearing only a label "Podops teter" in Walker's handwriting. There is no reference to locality. The type conforms to Walker's description and to that of Montrouzier 1861. A female specimen from Eccleston, New South Wales, compared with Walker's type is figured herewith (Pl. liii, fig. 10). Reference to the figure will show that Walker's statement in his description, "Thorax with an acute tooth on each side of the fore border and with another on each side near the hind border; a slight transverse ridge near the fore border," should prove a ready means of identifying the species.

Drawings of the specimen identified by Stål as *Scotinophara geophila* Montrouzier from North Australia, agree in all particulars with the type of *Podops teter* Walker, except that the acute tooth near the hind border is not represented as such in the drawings sent by Dr. Sjöstedt (Pl. lii, figs. 7, 8) but rather as an acute prominence.

Montrouzier in his 1861 description of the prothorax states: "Prothorax fortement tuberculeux sur le disque antérieur; celui-ci séparé du postérieur par un fort sillon. Côtés sineueux, présentant à la terminaison du sillon transverse, une petite dent et une autre à l'angle antérieur au-dessous des yeux. Angles postérieurs arrondis." Apart from this discrepancy the drawings of *Scotinophara geophila* Stål 1876 and the specimens of *Podops teter* Walker agree in the following characters: the dark brown area at the base of the scutellum and the dark line extending medially from it to the end of the scutellum and a light-ochraceous impunctate stripe extending from the middle of the anterior margin of the pronotum to the summit of the transverse ridge.

The length of Stål's specimen is given as 6 mm., and Montrouzier 1861 gives the same length; some of the specimens I have measured range from 6 to 6·5 mm.

The ventral surface of the abdomen conforms to that in the figure of *Storthecoris nigriceps* Horvath, given by Distant in the Fauna Brit. India, Rhynchota, i, p. 78, f. 37, being piceous with the lateral areas brownish-ochraceous.

I have not included in the above synonymy Schouteden's reference for the Genera Insectorum, fasc. 30, p. 34, pl. 3, f. 3, as the figure he gives is quite unlike the species I regard as *geophila*.

I erect a new genus for *Scutellera geophila* Montrouzier since its characters unfit it for inclusion in *Podops* or *Scotinophara*.

Hab.—Queensland: ? locality, 1 ♂, holotype (National Museum, Melbourne); Cairns district, 1 ♀, collected by Mr. A. M. Lea (S. Australian Museum); Port Denison, 1 ♂ (Macleay Museum).

New South Wales: Eccleston, 1 ♀, collected by Mr. T. G. Sloane (S. Australian Museum); Clarence River, 1 ♀ (Macleay Museum).

S. Australia: Northern Territory, King Island, 24th Dec., 1915, 1 ♂ (National Museum, Melbourne).

Genus SCOTINOPHARA *Stål,* 1867.

1867. *Scotinophara* Stål, Öfvers. Kongl. Vetenskaps-Akad. Förh., xxiv, p. 502.

1875. *Scotinophara* Stål, Kongl. Sv. Vet. Akad. Handl., Bd. 14, n. 4, p. 33.

1905. *Scotinophara* Schouteden, Genera Insectorum, fasc. 30, p. 33. Genotype, *Scotinophara fibulata* (Germar, 1839, *Podops*).

Distribution.—Europe, Asia, Africa, Australia.

SCOTINOPHARA ALLANÆ[3] *sp. nov.*

(Pl. liv, fig. 3.)

♀. Length 10 mm.; width across pronotal angles 5·5 mm.

Similar in general appearance to *Scotinophara coarctata* (Fabricius, 1798), larger, ochraceous-black, rugose.

Head 2·4 mm. across the eyes, black, clothed with brownish pubescence; eyes and ocelli brownish; rostrum extending to middle coxæ, ochraceous; antenniferous tubercles and basal segments of antennæ black, remainder brownish black; tylus slightly raised, jugæ flat and broad.

Pronotum black, coarsely punctate posteriorly with the ridges between the punctures ochraceous; anterior margin broadly concave, behind it a deep transverse impression extends to the lateral angles; near each anterior lateral angle occurs an acute tooth; lateral margins nearly straight and spined before pronotal angles; a shallow impression extends transversely across the pronotum above the lateral spines; posterior margin straight.

Scutellum ochraceous-black, rugose, extending almost to the end of the abdomen; fine brownish coloured pubescence in the black punctures; frena nearly a third of the length of the abdomen.

Hemelytra black punctate, ochraceous; membrane brownish on outer margin, otherwise hyaline.

Sternum dull-black, rugose.

Venter punctate, shining black, with ochraceous marks near the lateral margins.

Legs with coxæ, trochanters, and femora black, tibiæ and tarsi brown; tarsi and distal extremities of tibiæ with fine hairs.

♂. Length 9·9 mm.; width across pronotal angles 5·3 mm.

Similar in structure and appearance to the female.

Hab.—Northern Territory, July and August, 1912, 3 ♂, 3 ♀, collected by the late Prof. W. Baldwin Spencer (National Museum, Melbourne).

Types.—Holotype ♀, allotype ♂, and paratype ♀ in National Museum, Melbourne; paratypes ♀ and ♂ ♂ in Australian Museum.

A list of the Graphosomatid bugs at present known to occur in Australia and which are dealt with in this paper is given below.

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[3] Named in honour of Miss Joyce K Allan, who has contributed so many of the figures to this paper.

Tribe 1. GRAPHOSOMATARIA *Schouteden.*

Deroploa parva Westwood, 1834.

Deroploopsis curvicornis (Stål, 1876, *Deroploa*).
recticornis sp. nov.
bidentatis sp. nov.
brevicornutus sp. nov.
trispinosus sp. nov.

Eufroggattia tuberculata Goding, 1903.

Numilia subquadrata Stål, 1869.

Dandinus crassus Distant, 1904.

Testrica antica Walker, 1867.
bubala Stål, 1876.
hædulea Stål, 1876.

Protestrica rudis (Germar, 1839, *Podops*).
stali Schouteden, 1905.
subpunctatus (Walker, 1867, *Bolbocoris*).

Propetestrica trimaculata gen. et sp. nov.
angulata sp. nov.

Ippatha australiensis Distant, 1910.
ornata Distant, 1910.
angustilineata sp. nov.

Tribe 2. PODOPARIA *Stål.*

Coracanthella geophila (Montrouzier, 1858, *Scutellera*) nov. gen.

Scotinophara allanæ sp. nov.

EXPLANATION OF PLATE XLVII.

Meiolania platyceps Owen. Lord Howe Island.

Figs. 1-3. Right ulna, posterior, proximal, and distal views; F. 18827.

Figs. 4-6. Left fibula, postero dorsal, proximal, and distal views; F. 18833.

All figures natural size.

JOYCE K. ALLAN, del.

EXPLANATION OF PLATE XLVIII.

Meiolania platyceps Owen. Lord Howe Island.

Right humerus (F. 18750), radius (F. 18827), and ulna (F. 18827); antero-dorsal view.

Slightly more than half natural size.

JOYCE K. ALLAN, del.

EXPLANATION OF PLATE XLIX.

Meiolania platyceps Owen. Lord Howe Island.

Fig. 1. Left femur (F. 18756), tibia (F. 18833), fibula (F. 18833), astragalo-calcaneum (F. 18834), and toe bones (F. 18833); postero-dorsal view.

Fig. 2. Left astragalo-calcaneum, dorsal view.

About three-fifths natural size.

JOYCE K. ALLAN, del.

EXPLANATION OF PLATE L.

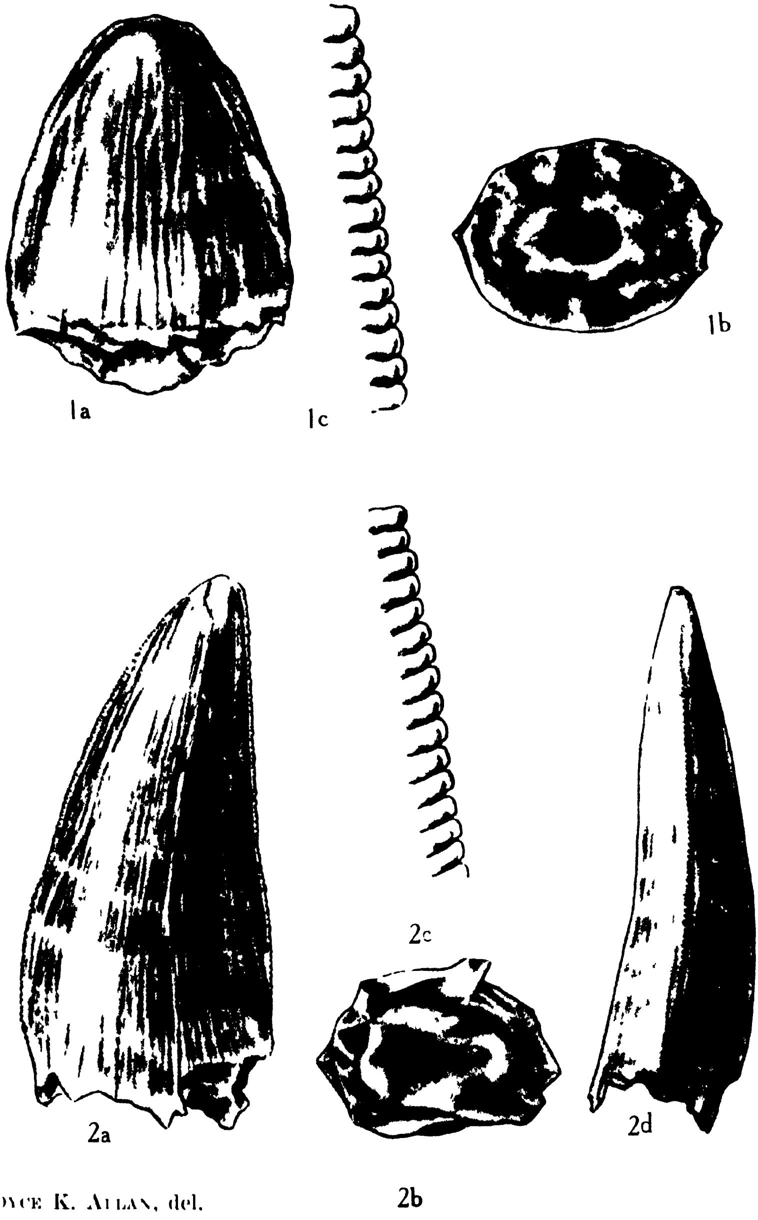
Teeth of *Varanus* (*Megalania*) *priscus* (Owen). Rosella Plains, Queensland.

Fig. 1. F. 25228.

Fig. 2. F. 25227.

a, inside view; *b,* basal view; *d,* posterior view. All four times natural size.

c, serrated edges. Sixteen times natural size.



JOYCE K. ALLAN, del.

EXPLANATION OF PLATE LI.

Varanus (*Megalania*) *priscus* (Owen). Darling Downs, Queensland. About two-thirds natural size.

Fig. 1. Left femur, posterior view; F. 2206.

Fig. 2. Left femur, ventral view.

Fig. 3. Right ulna, front view; F.2207.

hd., head; *tr. in.*, internal trochanter; *tr. ext.*, external trochanter.

3 2 1

C. G. CLUTTON, photo

EXPLANATION OF PLATE LII.

Fig. 1. *Testrica rudis* Germar. (Identified by Stål.) = *Protestrica rudis* (Germar). Dorsal surface.

Fig. 2. *Testrica rudis* Germar. (Identified by Stål.) = *Protestrica rudis* (Germar). Head and pronotum.

Fig. 3. *Deroploa curvicornis* Stål. Type. = *Deroploopsis curvicornis* (Stål). Head and pronotum.

Fig. 4. *Deroploa curvicornis* Stål. Type. = *Deroploopsis curvicornis* (Stål). Dorsal surface.

Fig. 5. *Testrica antica* Walker. (Identified by Stål.) Head and pronotum.

Fig. 6. *Testrica antica* Walker. (Identified by Stål.) Dorsal surface.

Fig. 7. *Scotinophara geophila* Montrouzier. (Identified by Stål.) = *Coracanthella geophila* (Montrouzier). Dorsal surface.

Fig. 8. *Scotinophara geophila* Montrouzier. (Identified by Stål.) = *Coracanthella geophila* (Montrouzier). Head and pronotum.

Fig. 9. *Testrica hædulea* Stål. Type. Dorsal surface.

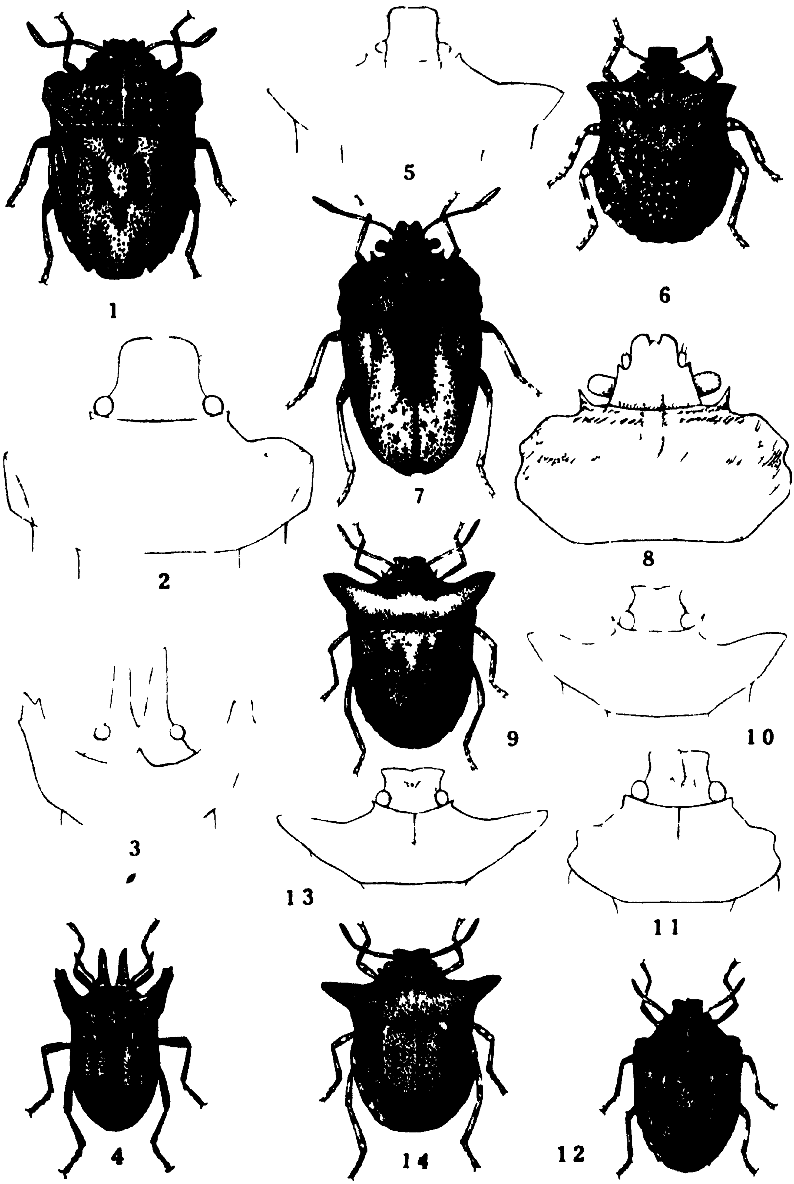
Fig. 10. *Testrica hædulea* Stål. Type. Head and pronotum.

Fig. 11. *Testrica emarginata* Stål. Type. = *Protestrica stali* (Schouteden). Head and pronotum.

Fig. 12. *Testrica emarginata* Stål. Type. = *Protestrica stali* (Schouteden). Dorsal surface.

Fig. 13. *Testrica bubala* Stål. Type. Head and pronotum.

Fig. 14. *Testrica bubala* Stål. Type. Dorsal surface.



Therese Ekblom, del.

EXPLANATION OF PLATE LIII.

Fig. 1. *Deroploopsis recticornis* sp. nov. Holotype. Male. Dorsal surface.

Fig. 2. *Deroploopsis recticornis* sp. nov. Holotype. Male. Ventral surface.

Fig. 3. *Deroploopsis recticornis* sp. nov. Holotype. Male. Head and pronotum.

Fig. 4. *Deroploopsis recticornis* sp. nov. Allotype. Female. Head and pronotum.

Fig. 5. *Deroploopsis bidentatus* sp. nov. Holotype. Male. Dorsal surface.

Fig. 6. *Deroploopsis bidentatus* sp. nov. Allotype. Female. Dorsal surface.

Fig. 7. *Deroploopsis curvicornis* Stål. Allotype. Female. Dorsal surface.

Fig. 8. *Eufroggattia tuberculata* Goding. Male. Lateral view.

Fig. 9. *Eufroggattia tuberculata* Goding. Male. Dorsal surface.

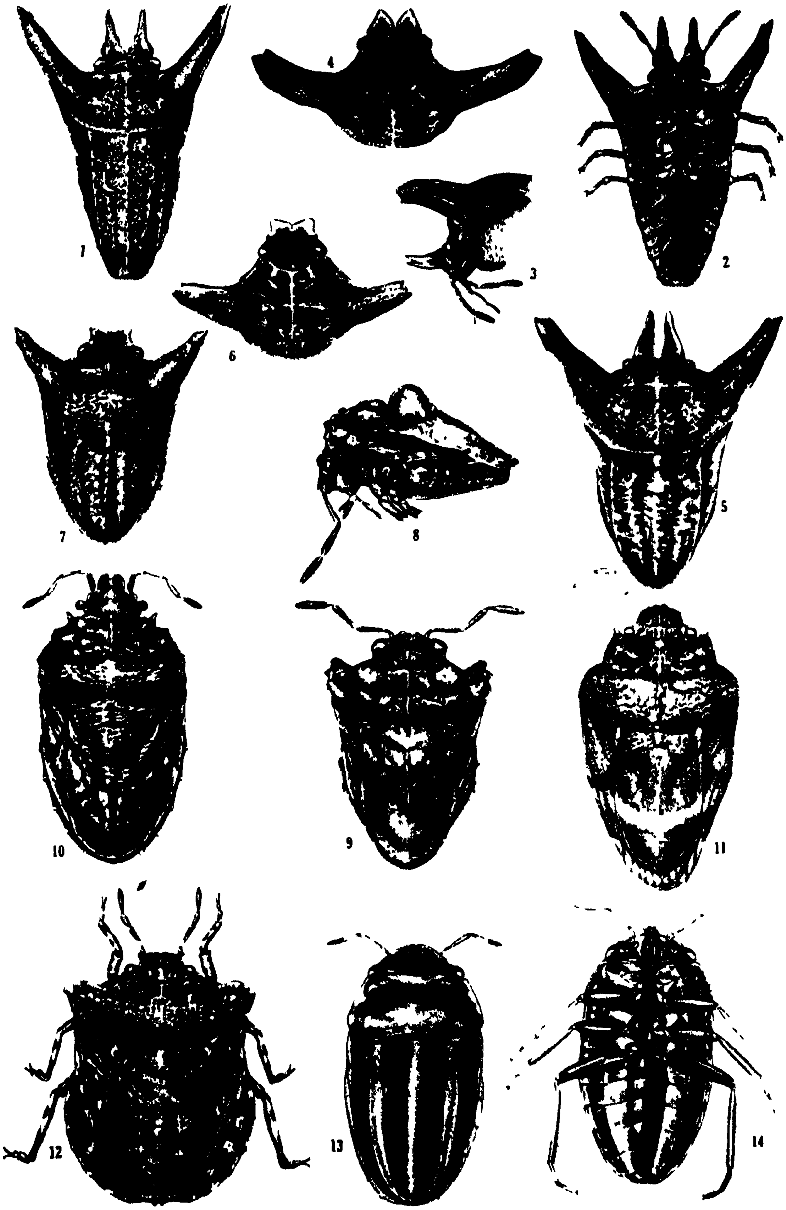
Fig. 10. *Podops teter* Walker. (Specimen compared with type.) = *Coracanthella geophila* (Montrouzier). Female. Dorsal surface.

Fig. 11. *Bolbocoris subpunctatus* Walker. Type. = *Protestrica subpunctata* (Walker).

Fig. 12. *Testrica antica* Walker. Female. Dorsal surface.

Fig. 13. *Ippatha australiensis* Distant. Female. Dorsal surface.

Fig. 14. *Ippatha australiensis* Distant. Female. Ventral surface.



JOYCE K. ALLAN, del.

EXPLANATION OF PLATE LIV.

Fig. 1. *Propetestrica trimaculata* sp. nov. Holotype. Female.

Fig. 2. *Propetestrica trimaculata* sp. nov. Holotype. Female. Head.

Fig. 3. *Scotinophara allanae* sp. nov. Holotype. Female.

Fig. 4. *Ippatha angustilineata* sp. nov. Holotype. Female. Dorsal surface.

Fig. 5. *Ippatha angustilineata* sp. nov. Holotype. Female. Ventral surface.

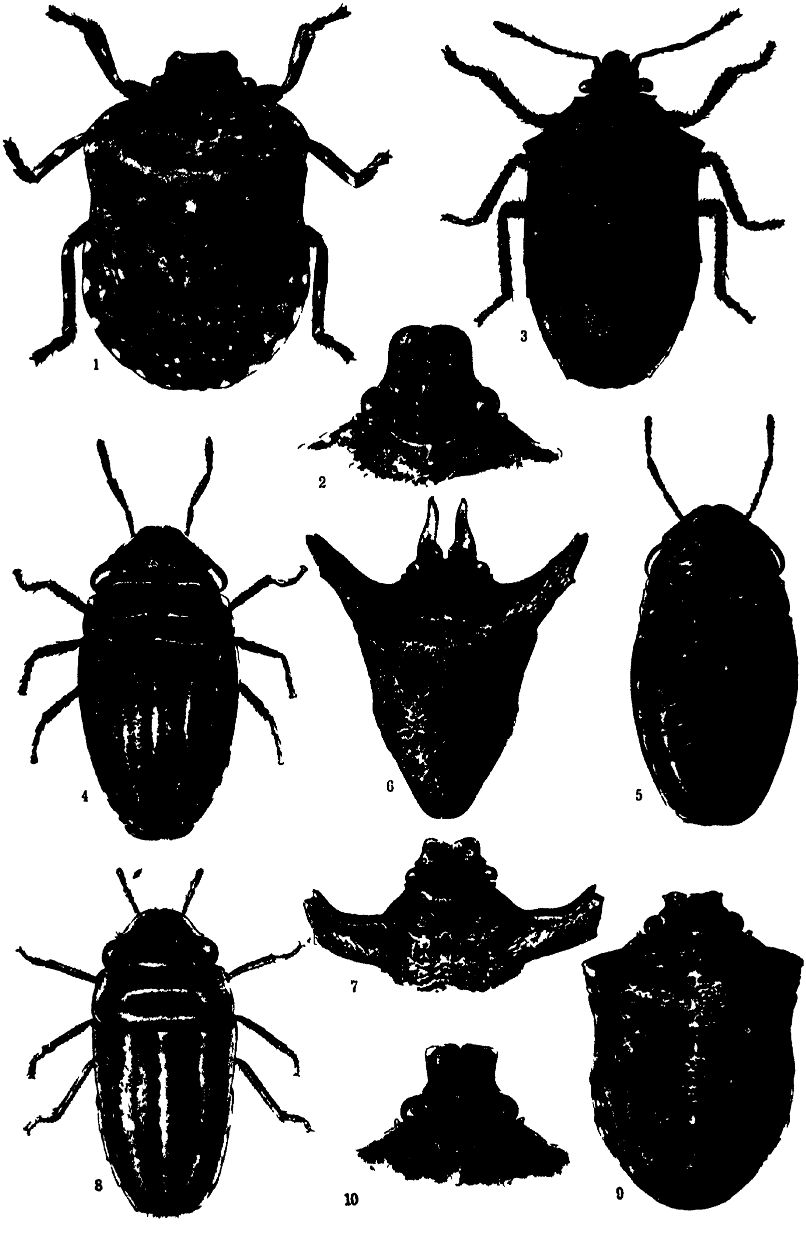
Fig. 6. *Deroploopsis trispinosus* sp. nov. Holotype. Male. Dorsal surface.

Fig. 7. *Deroploopsis trispinosus* sp. nov. Allotype. Female. Head and pronotum.

Fig. 8. *Ippatha ornata* Distant. Female.

Fig. 9. *Propetestrica angulata* sp. nov. Holotype. Male.

Fig. 10. *Propetestrica angulata* sp. nov. Holotype. Male. Head.



JOYCE K. ALLAN, del.

MANTIDÆ IN THE AUSTRALIAN MUSEUM.

By

NORMAN B. TINDALE,

South Australian Museum.

(Figure 1.)

Through the courtesy of the Trustees of the Australian Museum, Sydney, I have been able to study the Mantidæ preserved in that institution. Although the series is small it contains several species of considerable interest. In the following paper several new records are made and one new species, referred to a new genus allied to *Stenomantis*, is described. Notes on the synonymy of the Australian species are given in former papers[1] and are therefore not repeated here.

Subfamily PERLAMANTINÆ.

Genus PARAOXYPILUS *Saussure*, 1870.

PARAOXYPILUS TASMANIENSIS *Saussure*, 1870.

Locality.—New South Wales: Maroubra (November); Coogee (December); Sydney.

PARAOXYPILUS VERREAUXI *Saussure*, 1871.

Locality.—Queensland: Byfield, near Yeppoon (October); Almaden, near Chillagoe (January, a larva, October, adults).

PARAOXYPILUS ARMATUS *Giglio-Tos*, 1913.

Locality.—Queensland: Mabuiag Island in Torres Strait, one female.

Genus GYROMANTIS *Giglio-Tos*, 1913.

GYROMANTIS KRAUSSI (*Saussure*, 1871).

Locality.—Queensland: Powella, near Aramac (August); Almaden, near Chillagoe (May).

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[1] Tindale, N. B.—Records of the South Australian Museum, ii, 1923, pp 435-457, pl. xii-xxii and ii, 1924, pp. 547-552, pl. xxxix.

Genus CLIOMANTIS *Giglio-Tos*, 1913.

CLIOMANTIS DISPAR *Tindale*, 1923.

Locality.—Queensland: Powella, near Aramac (August); two males.

This species was previously only known from South Australia, where it is common in the arid interior districts.

Genus GLABROMANTIS *Sjostedt*, 1918.

GLABROMANTIS PALLIDIFEMUR *Tindale*, 1923.

Locality.—South Australia: Ooldea, two males. This species was described as a race of *G. unicornis* Tindale. It is probably best regarded as a distant species.

Subfamily IRIDOPTERYGINÆ.

RAWARENA *gen. nov.*

Allied to *Stenomantis* and to *Ima*. Head wide, compressed, eyes large and prominent; vertex nearly straight, with a rounded projection above eyes; clypeus transverse, quadrate, anterior margin waved, a median, longitudinal, marginal depression connecting with a deep, transverse, submarginal, arched impression; posterior margin convex; facial shield transverse, with the lateral angles well rounded; vertex with a tricarinate median projection; antennæ filamentous, reaching to about posterior margin of prothorax, clothed apically with fine sparse pubescence. Pronotum less than twice as long as wide, median carina well developed, with marked transverse impressions and conspicuous antero median, lateral, and posterior elevations. Elytra, in female, about as long as pronotum, the fore margin strongly rounded; elytra in the male elongate, narrow, extending well beyond the extremity of the abdomen, the fore margin nearly straight. Abdomen in female expanded laterally and tapering to anal extremity, apical tergite as long as wide, rounded posteriorly; cerci short and stout, pubescent, the apical segment elongate; the abdomen of male narrow, parallel-sided. Anterior legs with coxæ moderate, unarmed; femora long, widest at two-fifths, armed with three discoidal spines, the second the largest, the third smallest; inner margin with eleven seriate spines and an apical one arranged according to size as follows: SSsSsSsSssS s, outer margin armed with four large equal marginal and a smaller apical spine, tibiæ armed with eight graduated inner and six outer marginal spines, the latter arranged in series as follows: s ssssS; first segment of tarsi longer than the four following combined. Median and posterior legs with tarsi five segmented.

***Genotype.*—*Rawarena paraoxypila* sp. nov.**

This genus differs from *Stenomantis* in the armature of the anterior legs and in the form of the thorax. In the male the wings extend much beyond the extremity of the abdomen; in the female they are greatly reduced in size and are useless for flight. In *Stenomantis* the wings of both sexes are of about equal size; they do not reach the apex of the abdomen when in the position of rest, but the insects are able to fly. *Rawarena* differs from *Ima* in the armature of the anterior legs, in the pronotum, and in details of the head.

The generic name is adapted from an Australian aboriginal word for the "mantis."

RAWARENA PARAOXYPILA *sp. nov.*

(Figure 1.)

♀. Stout. Brown with darker markings. Head brown with obscure darker markings on vertex; eyes black. Pronotum dull brown with distinct rounded swellings and well-marked grooves. Elytra opaque, greyish, tinged with brown and with well-defined

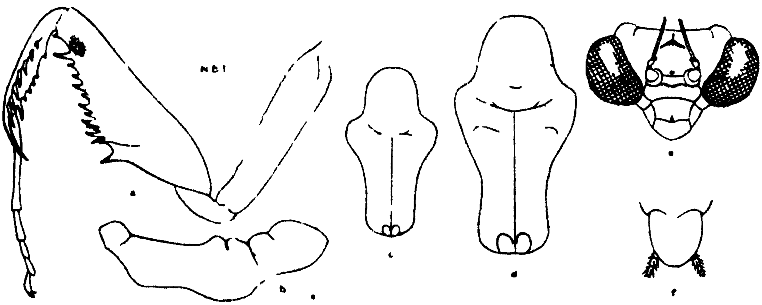

Figure 1.

Rawarena paraoxypila, sp. nov *a*, anterior legs of female, internal face; *b*, prothorax of female, lateral view, *c*, ditto of male, dorsal view; *d*, ditto of female; *e*, front view of head of female; *f*, apex of abdomen of female, dorsal view.

triangular basal and elongate subapical blackish marks. Abdomen reddish brown, three median segments with a triangular median longitudinal keel, the margins of these segments expanded and wrinkled (somewhat as in the females of the genus *Paraoxypilus*). Anterior legs pale brownish, the margins of coxæ and dorsal margins of femora with small blackish spots. Median and posterior legs brown with irregular blackish marks. Length of body, 20 mm.; of pronotum, 5·2 mm.; of elytra, 5·4 mm.; of anterior femora, 6·8 mm.; width of head, 4·0 mm.; of pronotum, 2·7 mm.

♂. Pale creamy brown. Smaller than female. Pronotum similar in shape, surface smoother, swellings more prominent. Elytra long, narrow, hyaline, iridescent, whitish, with four regularly disposed submarginal blackish marks, the first at about one-sixth from base, the fourth at three-quarters; costal and subcostal marginal black spots of small size also present and regularly disposed from near base to apex. Median femora with an orange annular mark situated just beyond one-half, margined on both sides with black. Length of body (without head), 16 mm.; of pronotum, 3·5 mm.; of elytra, 16 mm.; of anterior femora, 5·0 mm.; width of pronotum, 1·8 mm.

Locality.—New South Wales: Ulong, Dorrigo district, April, 1923 (W. Heron). Type, a female, in Australian Museum (reg. no. K.55943); allotype, male, in South Australian Museum (reg. no. I.18314).

The male specimen is unfortunately without the head and has therefore not been made the type. A single larva was captured at the same time as the type pair. It bears the number K.55944 and is 9 mm. in length.

Genus BOLBE *Stål*, 1877.

BOLBE NIGRA *Giglio-Tos*, 1914.

Locality.—South Australia: Kangaroo Island.

The single example obtained differs slightly from the typical Central and South Australian form.

Genus STENOMANTIS *Saussure*, 1871.

STENOMANTIS NOVÆ-GUINEÆ BISERIATA *Westwood*, 1889.

Locality.—Queensland: Almaden, near Chillagoe (October, November).

Subfamily MANTINÆ.

Genus ARCHIMANTIS *Saussure*, 1869.

ARCHIMANTIS LATISTYLA (*Serville*, 1839).

Locality.—New South Wales: Matraville (November), two males.

ARCHIMANTIS MINOR *Giglio-Tos*, 1916.

Locality.—Western Australia: Bornholm (December), 1 pair.

ARCHIMANTIS BRUNNERIANA *Saussure*, 1871.

Locality.—Queensland: Mt. Tambourine (December). New South Wales: Sydney (April, December). Willoughby (December). Hornsby, 2 males and 6 females.

ARCHIMANTIS QUINQUE-LOBATA (*Tepper*, 1905).

Locality.—New South Wales: Carinda, near Orange (March), one female.

The species has not previously been recorded from New South Wales.

Genus MANTIS *Linné*, 1758.

MANTIS OCTO-SPILOTA *Westwood*, 1889.

Locality.—Queensland: Yeppoon (October), Powella, near Aramac (August), two males.

Genus SPHODROPODA *Stål*, 1877.

SPHODROPODA MJOBERGI *Sjöstedt*, 1918.

Locality.—North-west Australia; Derby, one green-coloured male.

SPHODROPODA TRISTIS (*Saussure*, 1871).

Locality.—Queensland: Almaden, near Chillagoe (March, April). Of the three females under examination two are large and dark in colour; the third is smaller and may represent a variety. When more material is available for study our views regarding the species of *Sphodropoda* may need revision.

Genus RHODOMANTIS *Giglio-Tos*, 1916.

RHODOMANTIS QUEENSLANDICA *Sjöstedt*, 1918.

Locality.—Queensland: Almaden, near Chillagoe (April).

Genus TENODERA *Burmeister*, 1838.

TENODERA AUSTRALASIÆ *Leach*, 1814.

Locality.—New South Wales: Eastwood (April), Sydney (April), National Park (June), Canberra (April).

ETHNOLOGICAL NOTES.

No. II.

By

W. W. Thorpe, Ethnologist, Australian Museum.

(Plates lv–lviii.)

Introduction.

The native handiwork described in the following pages includes pieces from Netherlands New Guinea and the Mandated Territory. Most, if not all, are new to the Museum collections, and were received, with few exceptions, in an undocumented condition. The belief that some possess a "pre-Melanesian" interest has prompted their inclusion. The idea of lost races,[1] and incidentally cultures, is gaining many adherents; so much of evidential value has been and is being discovered, all tending to thrust back to remoter times the date of man's advent in the South Seas. Another factor now in operation that the systematist must keep in mind, is the modern transfer of material culture from one group of islands to another. As far back as forty years ago it was recorded that "The labour trade which bids fair to spread over the whole of the Pacific is rapidly destroying all the most characteristic work of the natives. Men of mature age are deported from their own Island to others, often many hundreds of miles away, and they thus carry with them and introduce what may be described as foreign arts into the culture of their new homes."[2]

It is hoped that this contribution as a whole will at least form an illustrated record of material culture varying in degrees of rarity and specialization.

Stone Bowl.

(Plate lv, fig. 1.)

This stone bowl, or more probably mortar, composed of a kind of tuff, is irregularly rounded in general outline, the periphery carrying a series of nineteen bosses or knobs, varied in size and spacing. The depression is shallow, its greatest depth being two inches, with a transverse diameter of four and a half inches. The lip of the depression is rounded and marked off by a slight annular depression.

It was discovered by Mr. Wallace Anderson, a pioneer of Edie Creek Goldfield, on a slate bottom, under nine feet of superimposed

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[1] Etheridge, R., Junr.—Rec. Austr. Mus., XI, 8, 1917, pp. 202-3.
[2] Edge-Partington and Heape—Ethnographical Album, First Series, 1890 (Preface).

material consisting of two feet of alluvial earth, five feet of puggy clay and two feet of wash. The site is said to be the old bed of Edie Creek, some sixty feet from its present course, in the hinterland of Salamoa Bay, Mandated Territory of New Guinea.

Weight, six pounds fifteen ounces. It is comparable with the stone mortars found of late years in the auriferous regions of British Papua.[3]

Crocodile-Jaw Daggers.

(Plate lv, fig. 2.)

Over a large area of New Guinea the tibia of the cassowary is utilized in dagger-making. There is no doubt of its being a favourite weapon of despatch with the Papuan. Similar thrusting weapons composed of wallaby bone have been observed at Orokolo, Papuan Gulf.[4] The most effective mode of attack seems to be a dextrous downward thrust behind the clavicle, causing the weapon to pierce the pectoral walls.

Another serviceable dagger is composed of the jaw-bone of the crocodile.[5] There are two examples in the Australian Museum from Netherlands New Guinea. One, thirteen and a half inches long, from the Wildemann River, the gift of Mr. J. W. Earnshaw, and the other, some eleven inches in length, from the Lorentz River, obtained by exchange. Both examples are formed from the left ramus of *Crocodilus porosus* Schneider. One has a tooth *in situ* and is decorated with two red seeds, while the other is entirely denuded of teeth and undecorated.

This type of dagger seems to be restricted to the southern rivers of Netherlands New Guinea.

Large Circular Shield.[6]

(Pl. lv, figs. 3-4.)

This is a very old specimen, bearing many marks of combat. The obverse is asymmetrically quartered in the form of a crude Maltese cross, with a central concentric "eye-spot." Each limb of the cross terminates in a series of grooves, two transverse and five to eight radially arranged. One limb in addition bears a star or flower-like design. Two of the deltoid depressions between the quartering show a raised carving which resembles the head of a

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[3] Chinnery, E. W. P.—Journ. Roy. Anthrop. Inst., XLIX, 1919, pp. 271-291 (with Bibliography).

[4] *Fide* S. G. Macdonell, who informed the writer that this variety is known as "hudaar." *Cf.* Neuhauss, R.—Deutsch-Neu-Guinea, Berlin, 1911, Band I, p. 136 *et seq.*

[5] Wirz, Paul.—Dämonen und Wilde in Neuguinea, Stuttgart, 1928, p. 309.

[6] *Cf.* Finsch, O.—Samoafahrten, 1888, Atlas, pl. 12, f. 1. Meyer and Parkinson.—Album, part 1, pl. 34. Edge-Partington.—Ethnographical Album, First Series, part 2, plate 276, fig. 1. A shield of this description was on sale in San Francisco in 1905, *vide* Catalogue of Nathan, Joseph, Austr. Mus. Pamphlets, 18989.

crudely barbed spear. All the decorative treatment is enclosed within a subperipheral ring.

The reverse is slightly concave, with two raised and perforated ridges to which is attached a three-ply bark fibre handle or grip.

Dimensions.—Diameter two feet seven inches, thickness varying from one inch to one and three-quarter inches.

Probably from the Finisterre Range, Maclay Coast, Mandated Territory of New Guinea.[7]

Coconut Ladle.

(Pl. lv, fig. 5.)

This utensil, said to be from the hinterland of Eitape, Mandated Territory of New Guinea, is new to the museum collections. The bowl portion consists of rather more than the basal half of a coconut plus a pointed section of the ascending wall. A stick handle passes through a perforation in the bowl, and is held in position with close and regular rattan lashing. The handle at this point is likewise perforated to receive part of the binding, the latter returning inside the ladle to the distal end. The proximal end of the handle is carved on the same plane with a bird-head representation, while immediately adjacent a cruder head is at right angles to the handle. Coconut ladles of simple form are figured by Neuhauss[8] and Reche.[9] The above described specimen is the first of its type brought under my notice.

Dimensions.—Length, two feet seven and one-quarter inches; bird-head carvings, six inches.

Massive Carved Bowl.[10]

(Pl. lvi, figs. 1-2.)

This is one of the most beautiful pieces of Papuan handiwork that have come under my notice. The bilateral symmetry, both of the bowl itself and the carved designs, is of more than usual interest. It is similarly carved on both sides and at the extremities, and there are indications that the decorative treatment, though now much worn, continued from end to end along the base. At each extremity an ovoid human face in an inverted position is incised, enclosed by panelling and a notched or tooth-like motive. These faces, following the contour of this part of the bowl, cause the chins to be somewhat pointed. Above each face is a lenticular

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[7] A shield of this type, embossed with a crude cross-fleurée is in the Auckland War Memorial Museum.

[8] Neuhauss, R.—Deutsch Neu-Guinea, Berlin, 1911, Band I, p. 251, fig. 161.

[9] Reche, O.—Ergebnisse der Südsee-Expedition, 1908-10, II, Ethnographie: A. Melanesian, Band I, Hamburg, 1913, p. 208, figs. 181-183.

[10] A smaller bowl, with inverted faces at the extremities, is in the Auckland War Memorial Museum.

bilobed design the significance of which is obscure. On each side of the bowl medially is a bird-like figure with outstretched wings in high relief, the tips terminating in a variation of the well-known Maori symbol known as the carved snake "manaia."[11] As a matter of fact there seems to be a definite Polynesian influence in the general decorative scheme. Skinner says: "I agree that the horizontal details are suggestive of Polynesian carving, particularly that of the Marquesas. The rendering of the nostrils in the human face is related to some Maori renderings of the nostrils."[12]

This vessel was acquired for the Australian Museum by Mr. Robert C. Dixson, and is probably from Tami, or Cretin Island, Huon Gulf, Mandated Territory of New Guinea.[13]

Dimensions.—Length, three feet two and one-quarter inches; depth, nine and a half inches; breadth, fourteen inches.

Skull Tablet, or "Mask."[14]

(Pl. lvi, fig. 3.)

This consists of a human skull attached to a shield-like frame composed of interlaced rattan. The facial portion has been "restored" in a resinous material and extended in a pig-like proboscis. The eyes are composed of rings of nautilus shell. The skull is surrounded by pig tusks embedded in the same resinous substance and a series of the same teeth has been continued below. The "field" of the tablet is irregularly decorated with inverted cowries, pieces of Melo shell and Coix seeds. A fibre fringe is attached to the outer margin of this interesting piece of Papuan handiwork. A somewhat similar tablet was presented to His Excellency, Lord Forster, Governor-General of the Commonwealth of Australia, upon the occasion of his official tour during September, 1924. In this case the tusks and other decorations were set in the wax of the native bee, and the specimen was of considerable weight.

The following data regarding the Museum specimen were kindly supplied by the Rev. F. J. Kirschbaum, S.V.D., resident missionary: "The mask is from the Keram tributary of the Sepik (Mandated Territory of New Guinea). The skull of the deceased was set up in this way and kept in the 'tamborang house.' Exhibited to young men during ceremonies to impress them." Dr. Kirschbaum added that the object belongs to the pig-totem section of the tribe.

Dimensions.—Four feet six inches; breadth, seventeen inches; length of proboscis, five inches.

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[11] Skinner, H. D.—Journ Polynes. Soc., XXXIII, No. 132, 1924, p 236, pl vii, figs. A and B.

[12] Letter dated at Dunedin, N.Z., April 19, 1925.

[13] Finsch, O.—Samoafahrten, Atlas, 1888, pl. 3, f. 3; Zeitschrift f. Ethnol., 1897, p. 129 *et seq.*; Edge-Partington, Ethnog. Album, First Series, part 2, pl. 291, f. 5.

[14] Thorpe, W. W.—Aust. Mus. Magazine, ii, 8, 1925 (Frontispiece). *Cf.* Haddon, A. C.—Man, XXIII, 6, June, 1923, Art. 50; and Reche, O.—Ergebnisse der Südsee-Expedition, 1908-10, Band I, Hamburg, 1913, p. 401, f. 422.

Fretwork Board.

(Pl. lvi, figs. 4-5.)

In this elaborately carved board, the design in the upper part is a grotesque human face. The nasal portion is cut *en bloc,* perforated, returning to the main design some distance down the board (Pl. xlviii, fig. 3). On each side of this process a tusk-like motive is carved and the major portion of the slab consists of a series of spiral coils, terminating centrally in two hornbill heads. The lower end of the board is more open, showing four dentate projections crossing two subspherical apertures. The Rev. Kirschbaum (see *ante*) informed the writer that these striking examples of perforated carving belong to the "hanging rack" series and were placed at the entrance to houses.[15]

This specimen was received unaccompanied by information as to locality, but it probably comes from Tambonum or Palimbai, Sepik River, Mandated Territory of New Guinea.[16]

Dimensions.—Length, five feet six and a half inches; greatest breadth, one foot eleven inches; length of nasal projection, two feet three inches.

Triangular Shield.

(Pl. lvii, fig. 1.)

This is a unique type of defensive weapon, said to have been collected on the head-waters of the Sepik River, Mandated Territory of New Guinea. There is no reason to doubt its authenticity, but it is quite new to the museum collections. It consists of a simple slab of light wood intentionally fashioned in a contorted manner, the reason for which is not apparent. A split-cane loop is attached to the upper end, this suspensory being partly covered with bark fibre. Probably carried from the left shoulder, the arm being thrust through the cane attachment. This is a very old piece, polished by contact with the body of the wearer.

Dimensions.—Breadth, eighteen inches; depth, sixteen inches; greatest thickness, seven-eighths of one inch.

Stone Mortar.

(Pl. lvii, figs. 2-3.)

This mortar is carved in the form of a human torso, the limbs being but slightly indicated, the face[17] flat and retreating. It is composed of diorite-porphyry and weighs two pounds three ounces.

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[15] Reche, O.—*Loc. cit.*, pl. xx, p. 126; Fuhrmann, Ernst.—Kulturen der Erde, xiv, 1922, p. 112.

[16] One very old and imperfect example and a comparatively modern one are in the Auckland War Memorial Museum. The latter is decorated with white and red pigment.

[17] *Cf.* Etheridge.—Records Austr. Mus. VI, 1, 1906, pp. 26-7, pl. vii.

The information as to its use is conflicting. When first brought under my notice it was said to have been used as a mortar for grinding abortion herbs. It was subsequently stated that these mortars with the abdominal depression were used for pounding the betel-nut for the old men who have no teeth, and the duty is carried out by the wives of the lapoon, as the aged are called, or else the daughters do this work. The illustrations are about half natural size.

From Manam (Vulcan) Island, Mandated Territory of New Guinea. Original in the possession of Capt. J. H. J. Johnson, Rabaul, New Britain. Coloured cast in the Australian Museum.

Human Effigy Hook.

(Pl. lvii, figs. 4-5.)

This is a wooden hook carved in the form of a male human figure, the lower extremities merging into a two pronged hook. It is well carved and is typically Sepik work. The nose is perforated, and the eyes are represented by the opercula of a *Turbo*; the mouth is coarsely rendered. The shoulders and back are cicatrized in a series of wavy lines. The arms terminate at the knees, with which they unite. The legs and feet end in a similar manner at the base of the figure. A perforated slot has been cut behind the head to accommodate a suspensory cord. From the ears, arms, and legs hang tasselled palm leaves, and, when received, the figure was clothed with a short "rami" or "pul pul." Several of these effigy hooks have been described and figured by Reche,[18] but none is quite as lifelike as the above described specimen.

Dimensions.—Length, three feet; breadth, across prongs, nine and a half inches; girth outside arms, twenty-two inches.

Bowstick.

(Pl. lviii, fig. 1.)

This black palmwood bow is medially oval in section, tapers towards the extremities and each end is provided with a peg thrust into a closely-plaited rattan socket. The exserted portion of one peg is bean-shaped and grooved, the other is angular and flat.

A somewhat similar bow is figured by Reche[19] from Vulcan Island, but it differs from this specimen in having the rattan binding in four cinctures, whereas the pegs are, in our specimen, entirely enclosed in the plaitwork.

Said to be from the head-waters of the Sepik River, Mandated Territory of New Guinea.

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[18] Reche, O.—*Loc. cit.*, pls. xl and xli, opp. pp. 164 and 172.
[19] Reche, O.—*Loc. cit.*, p. 337, fig. 369

Dimensions.—Length, five feet seven and a half inches; greatest girth, two and one-quarter inches.

Bent Club, or "Ripper."

(Pl. lviii, figs. 2-3.)

This weapon (Pl. lviii, fig. 2), having a more than superficial resemblance to the bent club of the Solomon Group[20] (Pl. lviii, fig. 3), has been described as a "ripper." It is stated on good authority[21] that it was "used for ripping up or disembowelling enemies, and has recently been sharpened."

Amongst savage peoples we find many clubs with pointed processes[22] set at various angles from the distal end, the object being to deliver a blow which will produce a punctured wound. In addition to being effective in this direction, this club possesses keen cutting edges both on the inner and outer curves. The latter is interrupted by a carved process which appears to be a debased or conventionalized human face.

Dimensions.—Length, three feet four inches: breadth of blade, five inches.

Tributary of Sepik River, 160 miles from coast, Mandated Territory of New Guinea.

Presented to the Australian Museum by Mr. R. A. Prescott.

Carved Spindle-Club.

(Pl. lviii, figs. 4-6.)

This club, said to be from New Guinea, has given the writer much concern. In general outline it resembles the *tiara* of New Ireland,[23] but the incised work at the distal end compares favourably with the handiwork of the Papuan. This combination of characters was puzzling until a somewhat similar but cruder design was noticed on the handle of a stone-headed club (Pl. lviii, fig. 6) from Hänischhafen, Mandated Territory of New Guinea.

The weapon about to be described had, in all probability, its origin in New Ireland and was traded to New Guinea, where the incised ornamentation was subsequently added. Parkinson says[24] that the *tiara* club was introduced into the Gazelle Peninsula,

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[20] Guppy, H. B.—"The Solomon Islands and their Natives," London, 1887, p. 73.

[21] *Fide* Prescott, R. A., Advance Agent, British Expedition to German New Guinea, 1924.

[22] *Cf.* Erskine, J. E.—Jnl. Cruise . . . Western Pacific, London, 1853, p. 178; Guppy, H. B.—"The Solomon Islands and their Natives," London, 1887, p. 74, fig. 5; "Zeitschrift f. Ethnologie," 1911, p. 245; Neuhauss, *loc. cit.*, p. 204, fig. 203; Skinner, H. D.—Journ. Royal Anthrop. Soc., XLIII, 1918, pp. 205-8.

[23] Parkinson, R.—"Dreissig Jahre in der Südsee," Stuttgart, 1907, pl. viii, opp. p. 112, figs. 1 and 5.

[24] Parkinson.—*Loc. cit.*, p. 283.

New Britain, from Cape Strauch district, New Ireland, so it is quite conceivable that the specimen under description was conveyed still further to New Guinea. The *tiara* is normally mushroom-headed. The present shape of this specimen, could, by reduction, be modified to its present double-headed hoe-like form.

It appears to be a two-handed weapon, one hand grasping the space between the two proximal collars and the other in advance of the whole series of four. Each face of the distal end, or head, is decorated with a design combining toothing and a central eye-spot. After several attempts a successful rubbing (Pl. lviii, fig. 5) was made of the main design. The dominating element is two human heads adorned with horns. Wavy, parallel, and zig-zag lines combined with triangular toothings, both in oval panels and free, produce a very interesting and effective appearance.

Dimensions.—Length, three feet eight and one-half inches.

Presented to the Australian Museum by Mr. G. J. Waterhouse.

EXPLANATION OF PLATE LV.

Fig. 1. Stone bowl or mortar. Edie Creek, hinterland of Salamoa Bay, Mandated Territory of New Guinea. Greatest diameter, 8½ inches.

Fig. 2. Crocodile-jaw daggers. The larger one is from the Wildemann River, the other from the Lorentz River, both localities in Netherlands New Guinea. 13½ and 11 inches long.

Figs. 3-4. Obverse and reverse of a large circular shield. Probably from Finnisterre Range, Maclay Coast, Mandated Territory of New Guinea. Diameter, 2 feet 7 inches.

Fig. 5. Coconut ladle. Hinterland of Eitape, Mandated Territory of New Guinea. Length, 2 feet 7¼ inches.

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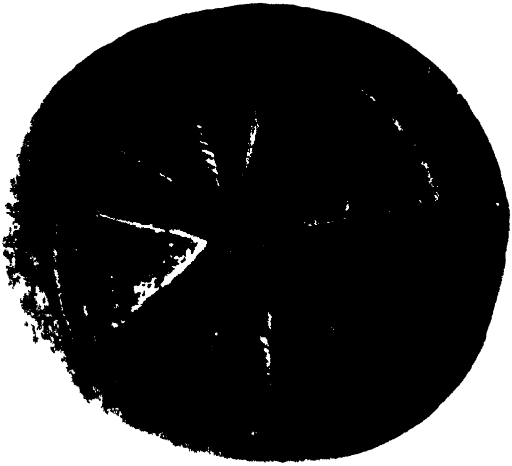

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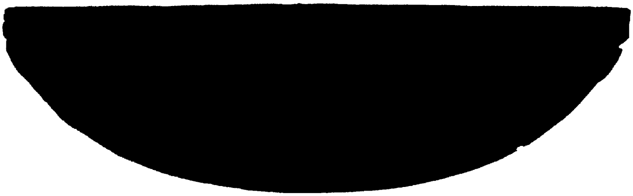
G. C. CLUTTON, photo.

EXPLANATION OF PLATE LVI.

Figs. 1-2. Massive carved bowl. Figure 2 illustrates the carving on an extremity. Probably from Tami, or Cretin Island, Huon Gulf, Mandated Territory of New Guinea. Length 3 feet 2¼ inches, depth 9½ inches, breadth 14 inches.

Fig. 3. Skull tablet, or "mask." Keram Tributary of Sepik River, Mandated Territory of New Guinea. Length 4 feet 6 inches, breadth 17 inches.

Figs. 4-5. Fretwork board. Probably from Tambonum or Palimbai, Sepik River, Mandated Territory of New Guinea. Length 5 feet 6½ inches, extreme breadth 1 foot 11 inches.



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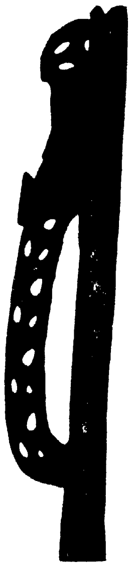

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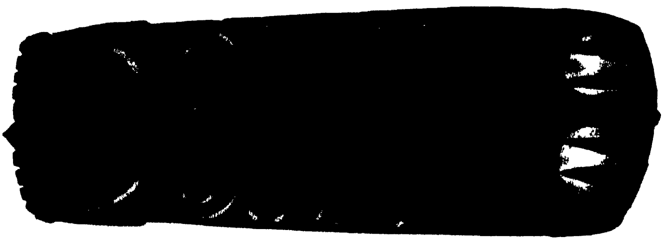

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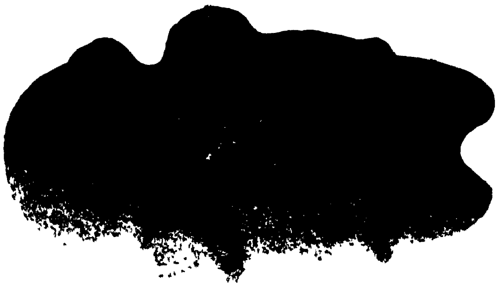
G. C. Clutton, photo.

EXPLANATION OF PLATE LVII.

Fig. 1. Triangular shield. Probably from head-waters of the Sepik River, Mandated Territory of New Guinea. Breadth 18 inches, depth 16 inches.

Figs. 2-3. Stone mortar. Manam (Vulcan) Island, Mandated Territory of New Guinea. Length, 6 inches.

Figs. 4-5. Human effigy hook. Sepik River, Mandated Territory of New Guinea. Length 3 feet, breadth across prongs 9½ inches, girth outside arms 22 inches.



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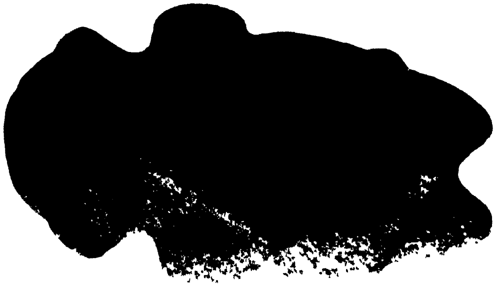

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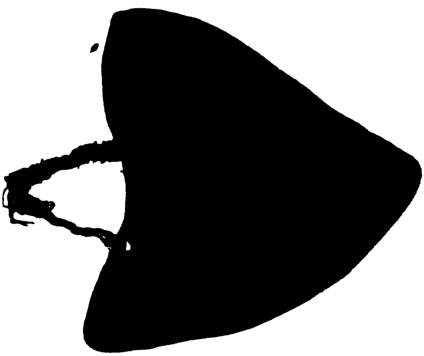

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G. C. CLUTTON, photo.

EXPLANATION OF PLATE LVIII.

Fig. 1. Bowstick. Probably from head-waters of Sepik River, Mandated Territory of New Guinea. Length, 5 feet 7½ inches.

Figs 2 3. Bent club, or "ripper." Tributary of Sepik River, 160 miles from mouth, Mandated Territory of New Guinea. Length 3 feet 4 inches, breadth of blade 5 inches.

Figs. 4 6. Carved spindle club. Probably originated in New Ireland and subsequently traded to New Guinea. Fig. 5 is a rubbing illustrating the design. Fig. 6 is a rubbing of a similar or cruder design on the handle of a stone headed club from Hänischhafen, Mandated Territory of New Guinea. Length, 3 feet 8½ inches.

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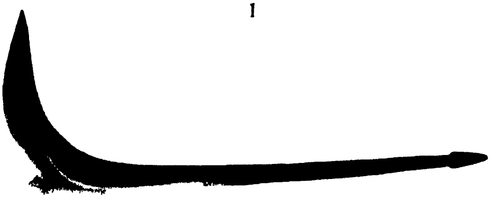

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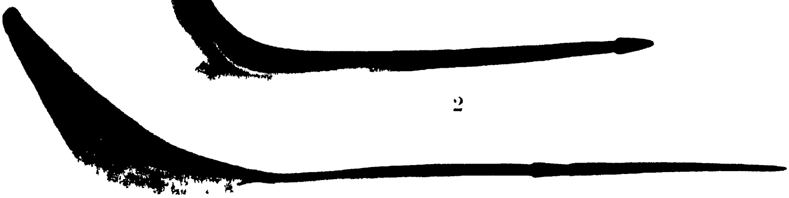

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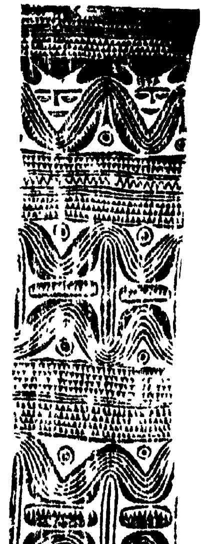

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G. C. CLUTTON, photo.

CARCINOLOGICAL NOTES.

No. I.

By

Frank A. McNeill, Zoologist, Australian Museum,

and

Melbourne Ward, F.Z.S., Hon. Zoologist, Australian Museum.

(With Plates lix-lxi and one Figure.)

Under the above title the authors contemplate publishing from time to time observations of interest on the Australasian Decapod and Stomatopod fauna. These will be in the form of accumulated notes on various species and not associated with projected contributions on representative collections from circumscribed areas. In effect, the object of the authors is to cleanse the Australasian literature, and present, incidentally, the knowledge that has been gained since the early work on the various species.

In the present paper many additions to the Australian fauna are recorded, and a number of old records are confirmed.

Some of the new records extend considerably the ranges of the species. In this regard *Eriphia norfolcensis* is recognized for the first time outside of its type locality (Norfolk Island, South Pacific) from the coast of New South Wales, and it is significant that no specimens of the species have ever come to hand from other localities on the eastern Australian coastline, which apparently have an environment more nearly approaching that of the type locality, and where intensive collecting has been carried out. Also, there is the recognition of the species *Cancer novæ-zealandiae*, formerly regarded as endemic in New Zealand, from the far removed Derwent River estuary in Tasmania, and from Port Phillip, Victoria.

Another point of interest is the recognition of a number of New South Wales species in South Australian waters. There is a close affinity between the Decapoda and Stomatopoda of these two States which has not been stressed in the past.

For the acquisition of some valuable species we are indebted to Captain L. Comtesse, master of the Sydney Harbour Trust's sand dredge "Triton." Captain Comtesse has brought to light a hitherto unsuspected array of specimens, crustacean and molluscan[1] and his collecting has enabled us to confirm several early records of typical tropical forms which had formerly been viewed with some doubt.

[1] Iredale.—Austr. Zoologist, v, 4, 1929, p. 337.

A

Family PANDALIDÆ.

Genus PANDALUS *Leach.*

PANDALUS LEPTORHYNCHUS *Stimpson.*

Pandalus leptorhynchus Stimpson, Proc. Acad. Nat. Sci. Philad., xii, 1860, p. 38. *Idem,* Haswell, Cat. Austr. Crust., 1882, p. 197. *Idem,* Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 224 (record only). *Idem,* Grant, *in* Sayce, Victorian Naturalist, xviii, 10, 1902, p. 155. *Idem,* de Man, "Siboga" Expd., Monogr. xxxixa^3, Decapoda, pt. iv, 1920, p. 103.

Parapandalus leptorhynchus Hale, Crust. S. Austr., pt. i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 43, fig. 34; and var. *gibber* Hale, *tom. cit.*, p. 44, fig. 35.

It is sixty-nine years since the original description of this species appeared, being based by Stimpson on material from Port Jackson, New South Wales, whence the form has not since been collected. In later years Haswell and then Whitelegge recorded the species on the authority of its author. The late F. E. Grant recognized the form from Port Phillip, Victoria, and our examination of specimens now in the Australian Museum collection and obtained at the above-mentioned locality by that author, confirms his determination. Again, Hale has established that the form occurs in dredgings in St. Vincent Gulf, South Australia.

Recently acquired specimens are in the Australian Museum from Botany Bay, New South Wales, which is close to the type locality (Port Jackson), and these confirm the occurrence of the species on the New South Wales coast, where it is perhaps not uncommon when dredged under certain conditions.

Material.—Six specimens from vicinity of Kurnell, Botany Bay, N. S. Wales; dredged in three fathoms from amongst seaweed on a bottom of sand; coll. M. Ward and F. A. McNeill, 1927. There are additional specimens in the Australian Museum from Port Phillip, Victoria (dredged), one specimen; coll. M. Ward.

Port Phillip, Victoria (dredged near entrance), two specimens; late F. E. Grant collection.

Flinders Island, Bass Strait (dredged in ten fathoms), four specimens; coll. W. E. J. Paradice, R.A.N., 1924.

George's Bay, N. E. Tasmania (dredged in 4½–3 fathoms); coll. Prof. T. T. Flynn, 10.2.1927.

Family HIPPOLYTIDÆ.

Genus HIPPOLYTE Leach.

HIPPOLYTE TENUIROSTRIS (*Spence Bate*).

Caradina tenuirostris Spence Bate, Proc. Zool. Soc. London, 1863, p. 501, pl. xl, fig. 4.

Virbius tenuirostris Ortmann, Proc. Acad. Nat. Sci. Philad., pt. iii, 1894, p. 406.

Hippolyte tenuirostris Hale, Crust. S. Austr., pt. i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 51, fig. 43; and Trans. Roy. Soc. S. Austr., li, 1927, p. 308, fig. 1.

This species is here recognized for the first time outside the waters of St. Vincent Gulf, South Australia. In the Australian Museum collection there are two ovigerous females from Botany Bay, New South Wales; they were dredged from amongst seaweeds growing on a bottom of sand in about fifteen feet of water. One specimen measures 5·5 mm. from the tip of the rostrum to the end of the carapace, and is approximately 18 mm. in total length; the other is slightly smaller in size.

We are indebted to Mr. H. M. Hale, Curator of the South Australian Museum, for the determination of the specimens.

Genus LATREUTES *Stimpson.*

LATREUTES TRUNCIFRONS (*Spence Bate*).

Caradina truncifrons Spence Bate, Proc. Zool. Soc. London, 1863, p. 499, pl. xl, fig. 2; and "Challenger" Zool., xxiv, 1888, Macrura, p. 582.

Latreutes truncifrons Ortmann, Proc. Acad. Nat. Sci. Philad., pt. iii, 1894, p. 406. *Idem*, Hale, Crust. S. Austr., pt. i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 51, fig. 44; and Rec. S. Austr. Mus., iv, No. 1, 1928, p. 93, fig. 20.

Like the preceding species, this form has not previously been recognized outside of St. Vincent Gulf, South Australia, and the present record considerably extends its range.

A single female example (with characteristically truncated rostrum) was collected in Gunnamatta Bay, Port Hacking, New South Wales, amongst weed in shallow water below low tide mark by Messrs. H. M. Hale and F. A. McNeill, February, 1927. The specimen was unfortunately later mislaid, but was about 18 or 20 mm. in length.

Family PROCESSIDÆ.

Genus PROCESSA *Leach.*

PROCESSA AUSTRALIENSE *Baker.*

Processa australiensis Baker, Trans. Roy. Soc. S. Austr., xxxi, 1907, p. 185, pl. xxv, figs. 2-2*e*. *Idem*, de Man, "Siboga" Expd., Monogr. xxxix*a*[3], Decapoda, pt. iv, 1920, p. 199, pl. xvii, figs. 51-51*m* (synonymy).

Processa australiense Hale, Crust. S. Austr., pt. i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 61, fig. 57.

Few references to this species occur in literature, and it is here recorded from New South Wales waters for the first time. The present record is based upon two ovigerous females measuring 8·5 mm. and 10 mm. from the tip of the rostrum to the end of the carapace; the largest specimen measures approximately 31 mm. from the tip of the rostrum to the end of the telson. While considerably larger than Baker's holotype both specimens agree perfectly with his description and figures, and the identification has been verified by Mr. H. M. Hale of the South Australian Museum, who compared one example with the holotype of *P. australiense*.

Locality.—Under stones between tide marks, Kurnell, Botany Bay, New South Wales. Coll. F. A. McNeill and M. Ward, 27th October, 1927.

Family STENOPIDÆ.

Genus Stenopus *Latreille.*

Stenopus hispidus (*Olivier*).

Stenopus hispidus Rathbun, Bull. U.S. Fish Comm., xx, 1900 (1901), p. 99, pl. ii (and synonymy). *Idem*, Adams and White, Zool. H.M.S. "Samarang," Crust., pt. ii, 1849, p. 61, pl. 12, fig. 6. *Idem*, Balss, Beiträge zur Naturg. Ost. (Abhand. d. math.-phys. Klasse d. K. Bayer. Akad. d. Wissen., II Suppl.-Bd., 10 Abhand.), 1914, p. 73. *Idem*, McNeill *in* Austr. Encyclopædia, ii, Sydney, 1926, p. 326, and figure.

Except for its inclusion in the "Encyclopædia" account quoted above, this unique tropicopolitan shrimp has apparently not previously been recognized from Australian waters, and it is now possible to record it from several localities on the eastern coast of this continent. The most remarkable of these new records is a specimen in the Australian Museum series recently collected in temperate Port Jackson on the New South Wales coast, which is probably the most southerly record for the species.

Material.—One specimen from Garden Island, Port Jackson; coll. Lieut. N. Glover, R.A.N. (in hand-net), May, 1924. One specimen from Dunk Island, off Cardwell, Queensland; coll. E. J. Banfield, 1909. One specimen from Green Island, off Cairns, Queensland; "old collection." Two specimens from Low Isles, off Port Douglas, North Queensland; coll. W. E. J. Paradice, R.A.N., 1924. One specimen from Hope Islands, North Queensland; coll. A. R. McCulloch, 1913.

In addition to the above series there are specimens in the Australian Museum from the following extra-Australian localities: Lord Howe Island, South Pacific (three); reef, Waikiki, Honolulu, Hawaiian Islands (one); Vila Harbour, New Hebrides (two).

The specimens are of varied age and size, the largest being a male from Lord Howe Island, which measures 24·5 mm. from the tip of the rostrum to the end of the carapace.

Habits.—When the late A. R. McCulloch visited the New Hebrides some years ago, as a guest of the Admiralty on board H.M.S. "Pegasus," he noted that the "species was common, living among the thick growths of marine life on the hulk of the S.S. 'Titus' in Vila Harbour. *Stenopus* of all sizes up to about four inches long moved about in search of minute food matter, which they picked up with their chelipeds. Their striking red and white colouration made them very conspicous, while their long delicate antennæ might be seen protruding from almost every crevice. Very young specimens were also caught on the surface at night in a net, being attracted, together with many other animals, by a brilliant electric light hung over the water."

Mr. M. Ward has collected the species on reefs, and observed that it frequents shallow water below low tide mark, where it may be searched for under movable dead coral blocks.

Colour.—Adams and White (*loc. cit.*) have published a very fine coloured figure of *Stenopus hispidus,* and the following notes made on the recorded Port Jackson female specimen when fresh will serve to supplement this.

Carapace pale sienna, with a median dorsal area tinged with green. Rostrum, anterior portion of carapace, eyes and bases of antennæ blood red, with still darker red patches. Large chelipeds each with four bands of similar red colour, two of which occur on the hands. Another red saddle across the middle of the abdomen, and one over the greater part of the last abdominal segment and base of the telson. Anterior portion of abdomen electric blue, largely by reason of the cobalt blue mass of eggs beneath, and the bases of all the legs deep violet. Uropods and most of telson porcelain white, with sienna markings. Flagella white, except where they are tinged with sienna towards their bases. Meral and carpal joints of all the limbs more or less tinged with sienna upon a ground of porcelain white.

STENOPUS ROBUSTUS *Borradaile.*

Stenopus robustus Borradaile, Trans. Linn. Soc. London, Zool., (2), xiii, 2, 1910, p. 260, pl. 16, fig. 4. *Idem,* McNeill, Austr. Zoologist, iv, 5, 1926, p. 302.

One of us (McNeill) first recorded this species from Australia in 1926, and apparently there are only two references to it in literature.

It is therefore interesting to note the discovery of further specimens in the collection of the Australian Museum from the eastern Australian coastline, where the species seems to be well established.

Material.—Three specimens from Masthead Island, Capricorn Group, Queensland, reef; coll. D. B. Fry. Four specimens from Hope Islands, near Cooktown, North Queensland, reef; coll. A. R. McCulloch. One specimen from Long Reef, Collaroy, on coast near Port Jackson, New South Wales, between tide marks; coll. M. Ward, 1924. The largest specimen in the present series measures 7 mm. from the tip of the rostrum to the end of the carapace.

Distribution.—Chagos Archipelago (type locality), and eastern Australian coastline.

Family CALLIANASSIDÆ.

Genus UPOGEBIA *Leach.*

UPOGEBIA SIMSONI (*Thomson*).

Gebia simsoni Thomson, Proc. Roy. Soc. Tasmania, 1892, p. 49, pl. i, figs. 3-5.

Upogebia simsoni Fulton and Grant, Proc. Roy. Soc. Victoria, n.s., xiv, 1902, p. 61, pl. v, figs. 5-6. *Idem,* McNeill, Austr. Zoologist, iv, 5, 1926, p. 305. *Idem,* Hale, Crust. S. Austr., pt i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 85; and Trans. Roy. Soc. S. Austr., li, 1927, p. 309.

A fine series of this species in the Australian Museum constitutes an addition to the New South Wales fauna, as well as an intermediate link in a long chain of distribution along the eastern and southern Australian coastline. The specimens provide another proof of the parallel nature of much of the New South Wales and South Australian decapod faunas.

Material.—Twenty-five specimens ranging from 6 to 10 mm., measured from the tip of the rostrum to the end of the carapace.

All were found hiding in accumulations of sand where clusters of shell-covered worm tubes occurred at the edge of a reef immediately below low tide mark at Kurnell, Botany Bay, New South Wales; coll. Messrs. F. A. McNeill and M. Ward, October 27, 1927, and January 21, 1928.

Another solitary specimen (carapace 7·5 mm. long) from Port Jackson, also in New South Wales, was collected by F. A. McNeill from a burrow in sand amongst stones between tide marks at Bottle and Glass Rocks on November 1, 1929.

Distribution.—East coast Tasmania (Thomson); Flinders, Western Port, Victoria (Fulton and Grant); North-west Islet, Capricorn Group, Queensland (McNeill).

Family PORCELLANIDÆ.

Genus POLYONYX *Stimpson.*

POLYONYX TRANSVERSUS (*Haswell*).

(Plate lix, fig. 3.)

Porcellana transversa Haswell, Cat. Austr. Crust., 1882, p. 150 (and reference).

Polyonyx transversus Baker, Trans. Roy. Soc. S. Austr., xxix, 1905, p. 262, pl. xxxvi, figs. 2-2*a*. *Idem,* Hale, Crust. S. Austr., pt. i, *in* Handbooks Flora and Fauna S. Austr., p. 63, fig. 80.

Although first described from Bowen in Port Denison, Queensland, and later recorded by Baker from South Australian waters, this species has not previously been recognized from an intermediate locality.

In the Australian Museum there are two male examples (carapaces 9 and 11 mm. wide) from stations in Botany Bay, New South Wales, which agree perfectly with the two type specimens housed in the same institution and constitute an addition to the fauna of the State. Both specimens were taken from "U"-shaped worm tubes, occupied by a species of the polychæt *Chætopterus,* where they were found reclining in the inflated basal portion of their sanctuaries, at a depth of about fourteen inches from the surface of the tidal flats exposed at low tide.

Mr. M. Ward collected a series of the species for the Australian Museum in July, 1929, from similar worm tubes occurring in the mud flats at low tide on Curtis Island in Port Curtis, Queensland. He remarked they were found in the soft mud at the extreme low tide line, or close thereto in shallow drains and pools. In each worm tube examined a male and female crab were present. The tubes were not more than one foot deep in the mud, and, owing to the fragile nature of their structure, great difficulty was experienced in digging them out.

Larger New South Wales specimen: Vicinity of Taren Point, near mouth of George's River, December, 1925. Smaller New South Wales specimen: Weenie Bay, south of Kurnell, June, 1928. Collected by G. Fraser.

Amongst some pencilled notes left by the late F. E. Grant is one referring to the collection of a single specimen of this species (afterwards presented to the British Museum) from "off Honeysuckle Point, Western Port, [Victoria] (4 faths.)." Verification of this record is provided by the presence of a small male of the species labelled "Western Port" in the collection of the National Museum, Melbourne, Victoria, recently examined by Mr. M. Ward, and forming part of the late F. E. Grant collection.

Discussion.—Hale has noted that the species "is apparently very rare in South Australian waters." The fact that so very few specimens have been recorded, however, combined with the evidence already to hand, suggests that the creature, like other species of the genus, is invariably a commensal. This would account for its apparent rarity in collections.

Genus PACHYCHELES *Stimpson.*

PACHYCHELES SCULPTUS (*H. M. Edwards*).

Porcellana sculpta H. M. Edwards, Hist. Nat. Crust., ii, 1837, p. 253.

Pachycheles sculptus de Man, Abh. Senck. Naturf. Ges., xxv, 3, 1902, p. 701. *Idem,* Grant and McCulloch, Proc. Linn. Soc. N. S. Wales, xxxi, 1, 1906, p. 40, pl. ii, fig. 1 (references and synonymy) and xxxii, 1, 1907, p. 155. *Idem,* Balss, Beiträge zur Naturg. Ost. (Abhand. d. math.-phys. Klasse d. K. Bayer. Akad. d. Wissen., II Suppl.-Bd., 9 Abhand.), 1913, p. 32.

A series of five specimens recently collected in New South Wales by M. Ward verifies the occurrence of this unmistakable species in an area far removed from its usual tropical environment. Grant and McCulloch (*loc. cit.,* 1906) noted the existence of New South Wales specimens in the Australian Museum collection, but these were Old Collection material even in those days, and we have considered that the record warranted confirmation. It would appear that the species occurs sporadically, or, being a commensal of encrusting sponges, has been overlooked by collectors in the past.

Material.—Two males and two females, and one immature juvenile, with carapaces ranging from 3 mm. to 5·5 mm. in width, from Long Reef, Collaroy, coast north of Port Jackson; in canals of a tough encrusting sponge on the under surfaces of flat stones occurring in shallow water below low tide mark. Collected by M. Ward, April 21, 1928.

Two males, with carapaces measuring 5 and 5·5 mm. wide, from Cabbage Tree Bay (Shelly Beach), Manly, on coast north of Port Jackson, New South Wales; collected by the late Thomas Whitelegge, Australian Museum. These are the specimens on which Grant and McCulloch's record of 1906 was based.

There are eight other specimens, in the Australian Museum from Masthead Island, Capricorn Group, Queensland; collected by Grant and McCulloch (see record, 1906).

Family LEUCOSIIDAE.

Genus EBALIA *Leach.*

Subgenus PHLYXIA *Bell.*

EBALIA (PHLYXIA) DENTIFRONS *Miers.*

Ebalia (*Phlyxia*) *dentifrons* Miers, "Challenger" Zool., xvii, 1886, Brachyura, p. 310, pl. xxv, fig. 4.

Ebalia dentifrons Fulton and Grant, Proc. Roy. Soc. Victoria, n.s., xix, pt. 1, 1906, p. 20. *Idem*, Ihle, "Siboga" Expd., Monogr. xxxixb^2, *Decapoda Brachyura* III. 1918, p. 310.

Phlyxia dentifrons Hale, Crust. S. Austr., pt. i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 200, fig. 201.

Although originally described from South Australian waters, this species, like others here recorded, is possibly more plentiful on the coast of New South Wales. Hale states that the form is rather rare in South Australia, and mentions that it has been collected in New South Wales. The latter statement was based on that author's examination of material of the species in the Australian Museum during a visit in 1927. In spite of the fact that, strictly speaking, the species has been recorded from New South Wales, we feel that further details of the actual material and localities are essential to consolidate the record.

Material.—Four females from Port Jackson, New South Wales; one female from Botany Bay, N. S. Wales. The largest specimen from N. S. Wales is a Port Jackson female 11 mm. wide. Other specimens in the Australian Museum are: One male from Beaumaris, Port Phillip, Victoria (dredged); one male from Flinders, Victoria; one female from the general locality—"South Australia."

The largest specimen examined is the male from Beaumaris, which is 12 mm. wide.

Occurrence.—Its occurrence in New South Wales is interesting from the fact that it may be dredged from depths up to five fathoms, and is also found on shore reefs in the shallows just below low tide level. In the latter situations it particularly favours clusters of shell covered worm tubes found growing in accumulations of sand and shell grit, amongst which the crabs lie concealed until the mass is torn from its anchorage and rent apart

EBALIA (PHLYXIA) RAMSAYI *Haswell.*

(Plate lx. figs. 3 4.)

Phlyxia ramsayi Haswell, Proc. Linn. Soc N. S. Wales, iv, 1. 1879 (1880), p. 55. *Idem*, Haswell, Cat. Austr. Crust., 1882, p. 127. *Idem*, Miers, Zool. "Alert," 1884, p. 252. *Idem*, Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 230 (mention only).

Ebalia (*Phlyxia*) *ramsayi* Miers, "Challenger" Zool., xvii, 1886, Brachyura, p. 305.

Besides Haswell's female holotype there are two other examples of this species in the collection of the Australian Museum. The form has not been recorded since it was originally described nearly forty years ago. As no figure of the species was given by Haswell, the present opportunity is taken to publish a photograph of the holotype.

Material.—One female from Port Jackson, N. S. Wales. Carapace 7 mm. wide, old collection. One female from Kurnell, Botany Bay, N. S. Wales; shore, 22.1.1928. Carapace 8 mm. wide. Mr. Melbourne Ward has an additional female specimen in his private collection from between tide marks at Long Reef, Collaroy, on coast north of Port Jackson, N. S. Wales. The male of the species is not known. A remeasurement of the holotype proves it to be 9 mm. wide.

Occurrence.—The species is found under similar conditions to those enumerated for *Ebalia* (*Phlyxia*) *dentifrons.*

LEUCOSIDES *Rathbun.*

Leucosides Rathbun, Proc. Biol. Soc. Wash., xi, 1897, p. 160; Proc. U.S. Nat. Museum, xxvi, 1902, p. 30.

LEUCOSIDES LONGIFRONS (*de Haan*), var. PULCHERRIMA (*Miers*).

Leucosia splendida Haswell, Proc. Linn. Soc. N. S. Wales, iv, 1, 1879, p. 47, pl. 5, fig. 1; and Cat. Austr. Crust., 1882, p. 119. *Idem,* Cox, Proc. Linn. Soc. N. S. Wales, vi, 2, 1881, p. 197. *Idem,* Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 230 (record only).

Leucosia longifrons, var. *pulcherrima* Alcock, Journ. Asiat. Soc. Bengal, n.s., lxv, pt. ii, no. 2, 1896, p. 219 (refs. and syn.).

It is now forty-nine years since Haswell described his *L. splendida* from Port Jackson, and no further evidence of its presence at that locality had come to hand until the receipt of two well preserved carapaces in July, 1929. These were presented to the Australian Museum by Capt. L. Comtesse, the master of the Sydney Harbour Trust's sand dredge "Triton," and were drawn up from about 6 fathoms in the vicinity of the Sow and Pigs Shoal. Both carapaces bear the characteristic markings of the variety *pulcherrima* Miers, and it is interesting to note that the trefoil markings do not coalesce. This last was used by Haswell to separate his Port Jackson *L. splendida* from *L. pulcherrima* Miers, but it has since been accepted that the character is subject to variation. Haswell also noted that "the circular figures are more remote from one another and from the trefoil marks" than in *pulcherrima.* That this feature is possibly due to age is demonstrated by the present material. The smaller carapace has the markings in much closer apposition and they appear more crowded than in the larger (carapaces 13·5 and 15·5 mm. wide respectively).

The female holotype of *L. splendida* is in the collection of the Australian Museum, and measures 22·5 mm. across the widest part of the carapace.

The variety is not uncommon in the tropical waters of eastern Australia. There are seventeen examples of both sexes in the Australian Museum collection from Port Denison and Dunk Island, Queensland, and Murray Island and Darnley Island, Torres Strait.

Cox (*loc. cit.*) refers to a plentiful supply of the variety at the Tweed River, northern New South Wales, but no further specimens have been reported from this locality, and no opportunity has presented itself to check the observation. None of the specimens of this record can be traced.

Leucosia polita Hess[2] is the only other species of *Leucosides* recorded from the temperate locality of Port Jackson, and is later quoted and requoted respectively by Haswell (*tom. cit.*, 1882, p. 120) and Whitelegge (*t.c.*, 1889, p. 230) on the authority of its author. Alcock (*t.c.*, 1896, p. 217) places the species in the synonymy of *Leucosides longifrons* (de Haan), quoting de Man[3] as his authority for this action. Unfortunately no trace of any such synonymy by de Man can be traced, either in the journal named by Alcock or elsewhere, which suggests a misquotation. On the evidence, however, we agree that Hess' species can be as well accommodated in its present position as elsewhere, for his description is meagre, and the figure accompanying it illustrates only a deformed cheliped. The now confirmed occurrence of *L. longifrons*, var. *pulcherrima* in Port Jackson strengthens the possibility of the presence of the typical form and a verification of Hess' Sydney record. But, owing to the fact that many of the species attributed to Sydney by Hess have not since been found, and are obviously incorrectly recorded (*e.g.*, several species of *Uca* and *Sesarma*), it is very probable that his *Leucosia polita* also was not collected there.

LEUCOSIDES HÆMATOSTICTA (*Adams and White*).

(Plate lx, figs. 7-8.)

Leucosia hæmatosticta Adams and White, Zool. H.M.S. "Samarang," Crust., pt. 2, 1849, p. 54, p. xii, fig. 2. *Idem*, Alcock, Journ. Asiat. Soc. Bengal, n.s., lxv, pt. ii, no. 2, 1896, pp. 214, 229 (references). *Idem*, Ihle, "Siboga" Expd., Monogr. xxxixb^2, Decapoda Brachyura iii, 1918, pp. 305, 306 (references).

We are able to record two examples of this well characterized Indo-Malaysian species from localities on the eastern Australian coastline; they constitute an addition to the Australian Decapod fauna, and add considerably to the range of the form.

Material.—One female example from Bowen Harbour, Port Denison, Queensland; collected by E. H. Rainford in 1923 on a

[2] Hess.—Archiv für Naturg., Jahrg. xxxi, 1865, p. 155, pl. vi, fig 14.
[3] de Man.—Zool. Jahrbüch. Syst., etc., ii, 1892, p 585 (*fide* Alcock).

muddy sandbank exposed at low tide (Australian Museum collection); one male from near Shark Beach, Port Jackson, New South Wales, dredged on May 10, 1929, in 2-3 fathoms, by M. Ward (M. Ward collection, Sydney).

Both specimens measure 13 mm. across the widest part of the carapace.

The Port Jackson record is remarkable, and adds another example to the list of tropical species recently proved to occur spasmodically at this temperate locality.

Distribution.—Indian seas, Malay Archipelago, and eastern Australian coastline.

Genus PHILYRA *Leach.*

PHILYRA PLATYCHEIRA *de Haan.*

(Plate lx, figures 5-6; and Figure 1.)

Philyra platycheira de Haan, *in* Siebold's Fauna Japonica, Crust. v, 1841, p. 132, pl. xxxiii, fig. 6. *Idem,* Balss, Archiv für Naturg., 88 Jahrg., Abt. A., Heft 3, 1922, p. 128 (references).

Philyra platychira Alcock, Journ. Asiat. Soc. Bengal, n.s., lxv, pt. ii, no. 2, 1896, pp. 238, 242 (references, but ? syn.).

Philyra platycheira Stimpson, Smith. Miscell. Coll., xlix, No. 1717, 1907, p. 154.

Three carapaces (10 to 12 mm. wide) have just been presented to the Australian Museum, and are considered referable to this

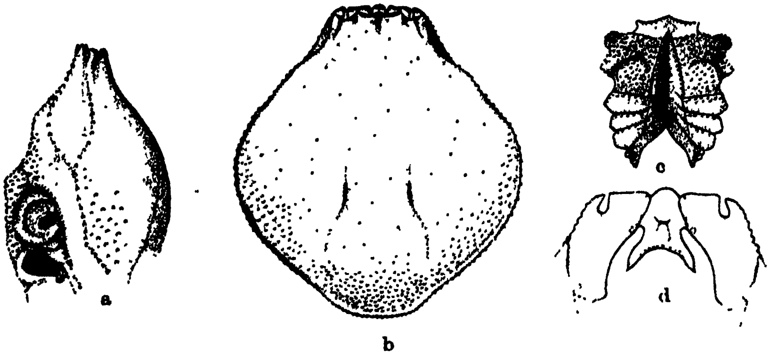

Figure 1.
Philyra platycheira **de Hann.** ***a*****, lateral view;** ***b*****, dorsal view;** ***c*****, sternum;** ***d*****, epistome. Example from Port Jackson; 11 mm. wide.**

species. One of the series has the sternum intact, and is that of a male; this has been used for the purpose of figuring the species in the present paper.

The important discovery of the specimens was made by Capt. L. Comtesse, who secured them from a depth of about 6 fathoms in the vicinity of the Sow and Pigs Shoal, Port Jackson, New South Wales.

A survey of the Museum reference collection revealed another previously unrecognized Australian specimen of the same species, a male (carapace 11·5 mm. wide) with chelipeds intact, but minus the ambulatory limbs. This was dredged in Albany Passage, north Queensland, by Messrs. C. Hedley and A. R. McCulloch in August, 1907. The characters of the carapace agree perfectly with the Port Jackson specimens, and the chelipeds are exactly as described by both de Haan and Alcock (*loc. cit.*).

The species has not previously been recognized from the Australian coastline, apart from the unsubstantiated mention of "Australische Küste" in the distribution given by Balss (*loc. cit.*), which is included below, and the record of a female example doubtfully designated by Miers in 1886[4] from 2-10 fathoms off the South Australian coast. This last-named author notes that his specimen had the pterygostomium regions "but very slightly angulated." As the present specimens agree in this particular with Miers', there is more than a possibility that the two records represent one and the same form. This is strengthened by the fact, stressed elsewhere in this paper, that there is a marked affinity between the crustacean fauna of New South Wales and South Australian waters. Further, Alcock (*loc. cit.*) does not stress the form of the pterygostomium regions in his description of *P. platycheira,* although they are depicted in de Haan's figure as nearly angular, and not definitely obtuse as in the local specimens before us, which we have critically compared with a male example of the species received in exchange by M. Ward from Ceylon. Nevertheless, there is complete agreement with the other important characters of the front, epistome and chelipeds as described by Alcock. De Haan's description is supplemented by Stimpson (*loc. cit.*), who notes the microscopic granulation of the carapace and its disposition. With this character also our specimens completely agree. Unfortunately, we have not been able to examine Japanese specimens, but feel that de Haan's figure is a little faulty in its outline.

Synonymy.—An apparently more granular form (*P. longimana*) from New Caledonia, with well marked cardio-branchial grooves extending forward on to the markedly produced anterior portion of the carapace, was described and figured by A. M. Edwards.[5] This

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[4] Miers.—"Challenger" Zool., xvii, 1886, Brachyura, p. 321.
[5] A. Milne Edwards.—Nouv. Archiv. du Mus. Paris, x, 1874, p. 43, pl. 2, fig. 4.

was considered by de Man[6] as closely allied to, and probably a variety of *P. platycheira*, but Alcock has definitely placed it in the synonymy of that species. We, however, would like further verification of Alcock's action, or a better acquaintance with the New Caledonian Decapod fauna before being satisfied that the two names are referable to one and the same species.

Affinity.—Ortmann's *P. syndactyla* from Japan[7] is a closely related species, but, though it has the antero-lateral outline as in *P. platycheira* of authors, the three main differences set out by Balss (*tom. cit.*, 1922, p. 129, fig. 7) appear sufficient to separate the two. In the character of the hand alone, *P. platycheira* has the fingers greatly flattened, with the cutting edges touching throughout their length, and the movable one is so strongly curved as to appear scythe-life. On the other hand, *P. syndactyla* is shown to have more slender and gaping fingers (*fide* Ortmann's figure, *loc. cit.*, and Parisi[8]), with the cutting edges unadorned with hair as in *P. platycheira*.

Distribution.—Japan (de Haan—type locality); Hongkong (Stimpson); South Australia (Miers); Philippines (Bell); Mergui Archipelago (de Man, Alcock); Andamans, Karachi, and Persian Gulf (Alcock); Dar-es-Salaam (Ortmann); "Dar-es-Salam, Rotes Meer, India, Japan, Australische Küste" (Balss); Ceylon (Laurie); Port Jackson, N. S. Wales, and Albany Passage, Queensland (McNeill and Ward—this paper).

Genus HETEROLITHADIA *Wood-Mason (Alcock).*

HETEROLITHADIA FALLAX (*Henderson*).

(Plate lx, figs. 1-2.)

Ebalia fallax Henderson, Trans. Linn. Soc. London, (2), Zool., v, 10, 1893, p. 402, pl. xxxviii, figs. 4-6.

Heterolithadia fallax Alcock, Journ. Asiat. Soc. Bengal, n.s., lxv, pt. ii, no. 2, 1896, p. 261. *Idem*, Ihle, "Siboga" Expd., Monogr. xxxix*b*², Decapoda Brachyura iii, 1918, p. 254 (references).

? *Leucosilia maldivensis* Borradaile, Fauna and Geography Maldive and Laccadive Archipelagoes, i, 4, 1903, p. 438, text-fig. 117.

A recent valuable acquisition to the Australian Museum is a locally collected male example of the above species, which measures 12 mm. across the widest part of the carapace. A female specimen (carapace 14 mm. wide) has also been discovered in the collection, and is undoubtedly referable to the same species. These are the first of their kind to be recorded from Australian waters, and considerably extend the known range of the form.

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[6] de Man.—Journ. Linn. Soc. Zool., xxii, 1888, p. 201.
[7] Ortmann.—Zool. Jahrb., Syst., vi, 1892, p. 583, pl. 26, fig. 18.
[8] Parisi.—Atti. del. Soc. Ital. di Sci. Nat., liii, 1914, p. 17, fig. 2.

Henderson's description is in perfect agreement with our specimens, but it is almost certain that the carapace he figured is that of his female or larger specimen, in which the flat tops of the tubercles are depicted as less enlarged than in the Australian Museum male. Our female specimen, which is only two-thirds the width of that recorded by Henderson, has the tubercles with narrow flat tops, and, though these are as numerous as in the other sex, their narrow extremities give the impression that they are less crowded on the carapace.

Material.—One male, dredged near Michaelmas Reef cay, Great Barrier Reef, off Cairns, north Queensland, 11 fathoms, hard bottom of foraminifera, sand and mud; coll. Messrs. C. Hedley, T. Iredale and G. P. Whitley, June 5, 1926. One female, dredged off Hope Islands, near Cooktown, north Queensland; coll. A. R. McCulloch, 1905.

Synonymy.—There is a strong possibility that Borradaile's *L. maldivensis* is identical with the above species. Borradaile does not state the sex of his unique specimen, but the figure shows a marked similarity to our Queensland female of *H. fallax*, particularly in the character of the tubercles. The breadth, too, is only 2 mm. less than in our female specimen, and both agree in that they are whitish in alcohol; the Australian male specimen is creamy to light brown in colour, with the bases of the chelipeds slightly stained with pink. A feature which requires verification is the character of the antero-lateral knobs. In our specimens these are more conspicuous than in Borradaile's figure of *L. maldivensis*, but the illustration may be faulty, and as the author makes no reference to the character of the knobs, it would be profitable to await an opportunity of examining his holotype or a photograph thereof before coming to a final decision on the matter.

Distribution.—Gulf of Manaar, India (Henderson, Laurie); Andaman Islands and Orissa coast, India (Alcock); Stn. 104, Sulu Sea, Malay Archipelago (Ihle).

Genus EBALIOPSIS *Ihle.*

EBALIOPSIS EROSA (*A. Milne Edwards*).

(Plate lxi, figs. 1-2.)

Ebalia erosa Alcock, Journ. Asiat. Soc. Bengal, n.s., lxv, pt. ii, no. 2, 1896, pp. 186, 189 (original references and synonymy). *Idem*, Borradaile, Fauna Maldive and Laccadive Archipelagoes, i, pt. iv, 1903, p. 437.

Ebalia (*Phlyxia*) *erosa* Bouvier, Bull. Sci. Fr. et Belgique (7), xlviii, 3, 1915, p. 222, text-fig. 18.

Ebaliopsis erosa Ihle, "Siboga" Expd., Monogr. xxxix*b*², Decapoda Brachyura iii, 1918, p. 255 (refs. and syn.).

A Queensland female specimen of this species (carapace 10 mm. wide) has recently been added to the collections of the Australian Museum, thus establishing the undoubted occurrence of the form in Australian waters. A. Milne Edwards' original description was based on a specimen in the Godeffroy Museum said to have come from Bass Strait. As this habitat could only refer to the well-known south-eastern Australian passage, the record must be accepted with suspicion. There are no previous records of tropical Leucosiids from an Australian station so far to the southward, and we are inclined to the belief that the original specimen must have been wrongly labelled. Haswell's Australian record of the species (1882, see Alcock, *loc cit.*) was based on that of A. M. Edwards'. A photograph of the newly recognized example is submitted in this paper, and is the first complete picture to be published since A. M. Edwards' excellent figure appeared in 1874.[9]

Locality.—Dredged near Michaelmas Reef cay, Great Barrier Reef, off Cairns, Queensland; 11 fathoms; hard bottom of foraminifera, sand and mud; coll. Messrs. C. Hedley, T. Iredale and G. P. Whitley, June 5, 1926.

Distribution.—"Habite le détroit de Bass," and New Caledonia (A.M.E.); Mauritius, Fiji, and Savage Island (Miers); Fiji Islands (Ortmann); Maldive Archipelago and Andaman Island (Alcock); Maldive and Laccadive Archipelago (Borradaile); Mauritius (Bouvier); Paternoster Islands, Gisser Island, Banda Sea, and off south coast of Rotti, Malay Archipelago (Ihle).

Family CALAPPIDÆ.

Genus CALAPPA *Fabricius.*

CALAPPA PHILARGIUS (*Linnæus*).

Calappa philargius Alcock, Journ. Asiat. Soc. Bengal, n.s., lxv, pt. ii, no. 2, 1896, pp. 141, 145 (refs. and synonymy).

Calappa cristata Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 231 (record only).

Whitelegge's lone Port Jackson, New South Wales, record appears to be the only notice of this species from Australian waters. The recent addition of several specimens to the Australian Museum collection confirms the occurrence of the form in Port Jackson, and it is interesting to note that the bulk of the localized material of the species in the same institution comes from New South Wales waters. The specimens before us establish a considerable extension of the species' range, seeing that its stronghold is the Indo-Malaysian and China Sea region, with a lone record from Samoa by Ortmann (see reference in Alcock, *loc. cit.*).

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[9] A. Milne Edwards.—Nouv. Archiv. du Mus. Paris, x, 1873, p. 47, pl. iii, fig. 2.

Material.—Four adult males from Port Jackson, New South Wales (it is probable that Whitelegge's record was based on one of these specimens); one adult male from Broken Bay, N. S. Wales; one adult male and one adult female from the general locality of New South Wales (one was obtained at the Sydney Fish Markets); one juvenile male (measuring 50 mm. between the tips of the postero-lateral spines) from Bowen Harbour, Port Denison, Queensland.

The largest specimen in the series is the male from "New South Wales," which measures 105 mm. between the tips of the postero-lateral spines.

In a letter to the late A. R. McCulloch, dated 4th June, 1912, the late J. D. Ogilby, then Ichthyologist at the Queensland Museum, stated that he had "obtained in Moreton Bay [southern Queensland] a magnificent *Calappa* about six inches [= 150 mm.] across, having a pair of large maroon spots on either claw, and a maroon horse-shoe [marking] around each eye; the general colour fawn with a tinge of lavender centrally." These remarks undoubtedly refer to the present species, and add another locality for its occurrence along the eastern Australian coastline. The size of the specimen seen by Ogilby probably constitutes a record.

Occurrence.—In New South Wales the species has been collected in shallow water where the bottom is soft and composed mainly or entirely of sand. Several specimens have been captured per medium of seine nets drawn by local fishermen.

Variation.—The juvenile Port Denison specimen before us has the carapace adorned with well marked but scattered tubercles, and many scattered granules occur inside the larger ones permanently present on the spines on the posterior border. Laterally several low longitudinal ridges can also be plainly seen. These characters occur irrespective of sex, gradually becoming modified with age, and when the full adult condition is attained there may be present only a few tubercles immediately behind the front. The growth variations are excellently shown in the figures of a juvenile and adult example of the species given by de Haan.[10]

CALAPPA HEPATICA (*Linnæus*).

Calappa hepatica Haswell, Cat. Austr. Crust., 1882, p. 136. *Idem,* Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 231. *Idem,* Alcock, Journ. Asiat. Soc. Bengal, n.s., lxv, pt. ii, no. 2, 1896, pp. 141, 142 (refs. and syn.). *Idem,* McNeill, Austr. Zoologist, iv, 5, 1926, p. 306. *Idem,* Ward, *tom. cit.*, v, 3, 1928, p. 243, and fig. on pl. xxvii.

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[10] De Haan.—*In* Siebold's Fauna Japonica, Crust. iii, 1837, p 71, pl. xix, figs. 1-1b.

Although known from the Australian coast, this tropical Indo-Pacific species of box-crab has not been recognized from a temperate locality since Whitelegge recorded the species from Port Jackson in 1889. Prior to this Hess[11] recorded the species from "Sydney" under the synonym *Calappa tuberculata* but much doubt attaches to his records from this locality, as he listed also a host of truly tropical species which could not possibly have occurred there. Whitelegge's original material of the species is still in the Australian Museum, and recently another specimen has been acquired from a station farther south than Port Jackson.

Material.—One adult male (carapace 61 mm. wide), one juvenile male (carapace 17 mm. wide), and one juvenile female (carapace 23 mm. wide) from Port Jackson, New South Wales, old collection; one or more of this series formed the basis of Whitelegge's record. One juvenile male (carapace 24 mm. wide) from Shellharbour, New South Wales, between tide marks amongst sand and shell grit on the floor of a boulder strewn gutter. Collected G. McAndrew, 1923.

Although Miers[12] records *C. hepatica* from New Zealand on the authority of Heller, its occurrence is doubted by Chilton and Bennett.[13] It therefore appears that the most southern locality at which the species has established itself is Lord Howe Island, eastward from the coast of New South Wales. There are ten examples of both sexes in the Australian Museum from this locality, which is rather remarkable for its possession of a coral reef and consequent coral fauna. Perhaps the Lord Howe Island stock has been responsible for the sparse New South Wales records of the species.

Family PARTHENOPIDÆ.

Genus ZALASIUS *Rathbun.*

Zalasius Rathbun, Proc. Biol. Soc. Washington, xi, 1897, p. 166 (proposed for *Trichia* de Haan, 1841; preoccupied by *Trichius* Fabricius, 1775, Syst. Entom., p. 40—Coleoptera).

Trichia de Haan, *in* Siebold's Fauna Japonica, Crust. v, 1841, p. 109 (type *T. dromiæformis* de Haan).

Macneillena Iredale, Austr. Zoologist, vi, 2, 1930, p. 175 (proposed for *Trichia* de Haan, 1841; preoccupied by *Trichia* Hartmann, 1840, Erd. u. Süssw. Gaster., p. 41—Mollusca).

Synonymy—The fact that *Trichia* de Haan was preoccupied by the molluscan genus *Trichia* Hartmann, was quite recently brought under our notice by Tom Iredale, and on receiving an assurance

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11 Hess.—Archiv für Naturg., Jahrg. xxxi, 1865, p. 157.
12 Miers.—Cat. Crust. New Zealand, 1876, p. 55.
13 Chilton and Bennett.—Trans. New Zealand Institute, lix, 1928 (1929), p. 775.

that the decapod genus had no alternative name, he proposed *Macneillena* for it. Unfortunately it was afterwards discovered that Rathbun had in 1897 given the name *Zalasius* to *Trichia* de Haan, on the ground of the latter's preoccupation by the coleopteran genus *Trichius* Fabricius. Although under other circumstances *Zalasius* Rathbun would be considered by us untenable,[14] the name now becomes definitely valid, and we regretfully relegate *Macneillena* to its synonymy.

Affinities.—In 1927 (see ref. *infra*) Hale placed this genus among the Parthenopidæ. No explanation was then offered, but in a letter to one of us the author stated that after an examination of the specimen of *Trichia* forwarded to him (see *infra*) he could not imagine the genus to be a true Brachyrhynch as supposed by Borradaile.[15] In his opinion the genus is an Oxyrhynch belonging to the sub-family *Parthenopinæ,* and the characters agree with those given for the Parthenopidæ by Borradaile (*loc. cit.*). A comparison of *Trichia* with such a genus as *Thryolambrus* shows many affinities, despite the fact that they are very different in form.

ZALASIUS DROMIÆFORMIS (*de Haan*).

(Plate lix, figs. 5-7.)

Trichia dromiæformis de Haan, *in* Siebold's Fauna Japonica, Crust. v, 1841, p. 110, pl. xxix, fig. 4 (male and female). *Idem*, Balss, Archiv für Naturg., 88 Jahrg., Abt. A., 11 Heft, 1922, p. 100 (references). *Idem*, Hale, Crust. S. Aust., pt. i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 143.

Trichia australis Baker, *Trans. Roy. Soc. S. Austr.*, xxx, 1906, p. 115, pl. iii, figs. 1-1*b*.

Trichia dromiæformis, var. *australis* Hale, *tom. cit.*, 1927, p. 142, fig. 145 (= photo. Baker's holotype).

Three specimens in the Australian Museum are identified as this apparently rare species, which was originally described from Japanese waters, and, apparently, has since been recognized only from Timor and Australia. The examples agree well with de Haan's description and figures, except for the presence of two well developed granular lobes protruding backwards from the first abdominal segment, which appear to have been damaged and are missing in the specimen figured by de Haan, or their absence is attributable to the more juvenile state of that author's original.

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[14] Although *Trichia* and *Trichius* have the same derivation, they are different names on the basis that a name is only a name and must be regarded as such. Further, it would be an interminable task to make all names comply with this rule It is worthy of note that Rathbun (*loc cit*) similarly changed the xanthid genus *Trapezia* to *Grapsillus* on account of the molluscan name *Trapezium*, but has since reverted to the use of *Trapezia*

[15] Borradaile.—Ann. Mag Nat. Hist (7), xix, 1907, p. 481.

This feature is shown in the illustration of a denuded male of the Australian Museum series appearing in this paper.

Material.—One female (carapace 49 mm. wide) and one male (carapace 42 mm. wide) from Queen's Beach, Port Denison, Queensland; one female (carapace 45 mm. wide) from Bowen Harbour, Port Denison, Queensland. These specimens were collected in 1922 and 1925 by Mr. E. H. Rainford of Bowen, Queensland, who has done much valuable work in the field for the Trustees of the Australian Museum. Data as to their actual occurrence are wanting, but it is certain that they were collected between tide marks on the shore.

A fourth male specimen of the above series was forwarded to H. M. Hale of the South Australian Museum, and caused him to establish a new record for *T. dromiæformis* in the remark: "has been taken in Japan and Queensland" (*loc. cit.*, 1927). This brief statement contains the first record of *T. dromiæformis* outside of its type locality.

Synonymy.—Upon careful comparison of the male holotype of Baker's *T. australis* with the Queensland specimen of *T. dromiæformis* in the South Australian Museum and de Haan's description and figures, Hale informs us (*in lit.*) that Baker's species is only a variety of *T. dromiæformis*. *T. australis* is 18 mm. long (*fide* Baker), being only about 7 mm. less than the length (1 inch, *fide* de Haan) stated for *T. dromiæformis* by its author. This fact supports Hale's observations on the differences between the two forms. In reference to the absence of tomentum on the southern form, Hale has informed one of us (*in lit.*) that "Baker said his *Trichia australis* had no hairy clothing, but here and there on his type are the basal parts of broken off hairs amongst the granules, while tucked away where the legs rest against the body a few long hairs still remain." Following on this statement came further news from Hale of the acquisition in 1929 of a second specimen (female) of *T. australis*, collected at the type locality, Port Willunga, South Australia, by W. J. Kimber. The specimen, we learn, resembles Baker's male holotype, but has more hair in the grooves of the carapace and on the outsides of the chelipeds. Nevertheless, the hairy clothing is stated to be not nearly so pronounced as in typical *T. dromiæformis*. The finding of a second specimen of *T. australis* has not shaken Hale's belief that the southern form is only a variety of *T. dromiæformis*, just as the southern Australian Hymenosomid, *Elamena* (*Trigonoplax*) *unguiformis* (de Haan), var. *longirostris* McCull[16] is a variety of its typical form, which, like *T. dromiæformis*, occurs in Japan.

The illustration of *T. dromiæformis* var. *australis* appearing in this paper is from a duplicate photograph of the holotype sent us

[16] McCulloch.—Rec. Austr. Mus., vii, 1, 1908, p. 59, pl. xii, fig. 3.

by Hale, and is a replica of the one reproduced in his "Handbook" (*loc. cit.*, 1927).

Family CANCRIDÆ.

Genus Cancer *Linnæus*.

Cancer novæ-zealandiæ (*Jacquinot and Lucas*).

(Plate lxi, figs. 3-7.)

Platycarcinus novæ-zealandiæ Jacquinot and Lucas, Voy. au Pole Sud., iii, Crust., 1853, p. 34, pl. iii, fig. 6.

Cancer novæ-zealandiæ Chilton and Bennett, Trans. N. Zeal. Instit., lix, 1928 (1929), pp. 735, 744 (references and synonymy).

Up to the present this species has been considered an endemic New Zealand form. Its recent discovery in abundance in Tasmanian waters must therefore come as a surprise to many workers.

In the Australian Museum there are several examples from the Derwent River estuary, in the vicinity of Hobart. These agree perfectly with the descriptions and figures of the species, and with other New Zealand specimens of *Cancer novæ-zealandiæ* also in the collection.

Material.—Tasmanian series: Five males and one female, with carapaces ranging from 53 mm. to 112 mm. in width. Also three carapaces of individuals of medium size. New Zealand series: Four males and three females, with carapaces ranging from 28 to 91 mm. in width. Six of these examples were collected by the late Charles Hedley in December, 1918; four from under stones on the beach at Portobello, Port Chalmers, and two from the shore in Blueskin Bay, near Port Chalmers; the remaining female specimen of the series is from the general locality "New Zealand," and was collected by the late R. Helms.

In the collection of the National Museum, Melbourne, Victoria, Mr. M. Ward has recently noticed several specimens of the species labelled Mentone, a locality in Port Phillip. This record is a further extension of the remarkable range of the species.

Occurrence.—The Tasmanian specimens were all collected in the vicinity of the shipping wharves at Hobart, where the species is surprisingly common. Several examples were secured by Mr. Ward in a baited, circular, shallow net which was lowered to a depth of forty feet. Individuals were observed by the same collector moving about on the bottom in the shallow water at the same place. The other complete specimen and the three carapaces of the Tasmanian series were collected by Mr. C. Lord, Director of the Tasmanian Museum, at the same locality.

Mr. T. Iredale, conchologist at the Australian Museum, suggests that the species has become established in Tasmania as the result of the introduction of New Zealand oysters, which were introduced about fifty years ago, and are now firmly established.

Variation.—The greatest variation is to be observed in a juvenile female, in which the carapace (28 mm. wide) is markedly granular, particularly on the gastric and adjacent regions, but with the granules becoming obsolete near the frontal, lateral, and posterior margins. The regions are defined by smooth, shallow channels, and the characteristic grooves between the frontal lobes are deep, conspicuous, and continued backwards to the anterior margins of the gastric regions. Other specimens of the series before us have the carapace almost smooth, or with the regions appearing in varying degrees of prominence as ill-defined nodular swellings, irrespective of age or sex. In the same way the frontal grooves may be either clearly defined or indistinct. The photographs of the species submitted in this paper serve to illustrate features of the variation described above.

Family PORTUNIDÆ.

Genus LISSOCARCINUS *Adams and White.*

LISSOCARCINUS POLYBIOIDES *Adams and White.*

(Plate lix, fig. 4.)

Lissocarcinus polybioides Adams and White, Zool. H.M.S. "Samarang," Crust. pt. ii, 1849, p. 46, pl. xi, fig. 5. *Idem,* Haswell, Cat. Austr. Crust., 1882, p. 83. *Idem,* Miers, Zool. H.M.S. "Alert," 1884, p. 541. *Idem,* Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 228. *Idem,* Alcock, Journ. Asiat. Soc. Bengal, n.s., lxviii, pt. ii, no. 1, 1899, p. 19 (with references). *Idem,* Borradaile, Fauna Maldive and Laccadive Archip., I, 2, 1902, p. 200. *Idem,* Balss, Archiv für Naturg., 88 Jahrg., Abt. A., 11 Heft, 1922, p. 102 (with references). *Idem,* Hale, Crust. S. Austr., pt. i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 146.

The original source of this species was vaguely given by Adams and White in 1848 as "Eastern Seas," and it was not until 1884 that Miers thoughtfully published the information that the type specimens in the British Museum came from Borneo. Meantime Haswell (1882) had recognized the form from Port Jackson, New South Wales, and this record was the first to be published with a specific locality appended. Haswell's specimens are still in the Australian Museum. Whitelegge later recorded *L. polybioides* from Port Jackson, but he obviously followed Haswell, and had access to that author's material in order to verify the original determination.

Latterly some doubt was felt in the Australian Museum as to the validity of Haswell's Port Jackson locality for *L. polybioides*, although it was supported by Mier's South Australian "Challenger" record of 1886 (see Alcock *loc. cit.*). Quite recently, however, a further specimen of the species has come to hand which confirms Haswell's record of forty-seven years ago and adds another to the tropicopolitan decapods which so curiously establish themselves in this outpost of their range. Further examples of the species are recorded below from Queensland, and constitute an addition to the fauna of that State.

The references to the species appearing above are intended to be as full as possible, and should cover every record that has appeared in literature. No previous effort of this nature has yet been attempted.

Material.—Two males and two females (carapaces 2 to 5 mm. wide) from Port Jackson, N. S. Wales (Haswell's original series). One female (carapace 14 mm. wide) from Port Jackson, N.S.W.; dredged in April, 1929, from 6 fathoms, vicinity Sow and Pigs Shoal, Sand Dredge S.S. "Triton"; coll. Capt. L. Comtesse. One adult male from Port Molle, Queensland (carapace 19 mm. wide); old collection. Two males and two females (carapaces 12 to 20 mm. wide) from Port Denison, Queensland, and vicinity. One of these was taken from the branches of a clump of live coral drawn from a depth of 15 feet. Coll. E. H. Rainford, Bowen, Queensland, in 1918, 1922, and 1923.

The excellent figure by Adams and White is apparently the only one published, and we, therefore, feel justified in depicting in this paper the recently acquired Port Jackson specimen.

Colour.—The freshly preserved Port Jackson specimen is coloured a light brownish red on the carapace; ambulatory limbs with brownish and white bands; chelipeds brownish above, with two bands of brownish red on the otherwise white movable fingers.

Distribution.—Indo-Malaysian region, China seas, and east and south-east coasts of Australia.

Genus LIOCARCINUS *Stimpson*.

LIOCARCINUS CORRUGATUS (*Pennant*).

Cancer corrugatus Pennant, Brit. Zool., iv, 1777, p. 5, pl. v, fig. 9.

Portunus corrugatus Miers, "Challenger" Zool., xvii, 1886, Brachyura, p. 200 (refs. and syn.). *Idem*, Ortmann, Zool. Jahrb., Syst., vii, 1893, p. 70 (refs. and syn.). *Idem*, Fulton and Grant, Proc. Roy. Soc. Victoria, n.s., xix, 1906, p. 18 (record only). *Idem*, Chilton and Bennett, Trans. N. Zeal. Inst., lix, 1928 (1929), p. 753 (refs).

Liocarcinus strigilis Rathbun, Proc. U.S. Nat. Mus., xxvi, No. 1307, 1902, p. 25; and in Stimpson, Smith, Misc. Colls., xlix, No. 1717, 1907, p. 74, pl. ix, fig. 6 (posthumous).

Portunus corrugatus strigilis Balss, Archiv für Naturg., 88 Jahrg., Abt. A, 11 Heft, 1922, p. 101 (refs. and syn.).

Liocarcinus corrugatus Hale, Trans. Roy. Soc. S. Austr., li, 1927, p. 311 (record only); and Crust. S. Austr., pt. i, *in* Handbooks Flora and Fauna S. Austr., 1927, p. 148, fig. 149.

Although this cosmopolitan species has been recognized from South Australian waters (*fide* Hale), it has not previously been recorded from the New South Wales coast. The three specimens recently acquired by the Australian Museum, although juvenile, are clearly referable to this well characterized form.

Material.—One male (carapace 8 mm. wide) from off Botany Bay to Wata Mooli, N. S. Wales, 50 fathoms. Collected by Mr. M. Ward from the deck of the trawler "Thistle." One male and one female (carapaces respectively 11 mm. and 9·5 mm. wide) from off Green Cape, N. S. Wales, 40 fathoms. Collected by trawler Capt. K. Möller, July, 1926.

Also in the Australian Museum collection are several adults of both sexes from Mevagissey, English coast (three specimens), Mediterranean Sea (three specimens) and Bay of Naples, Italy (two specimens).

The largest specimen of the series is a male measuring 44 mm. between the tips of the last pair of lateral spines.

Mr. H. M. Hale, Curator of the South Australian Museum, has forwarded some notes on his series of four specimens from South Australian waters. He says "the median tooth of the front is obtuse in only the smallest; the other three specimens have a right-angled rostrum. The length of the carapace is 0·80, 0·86, 0·87 and 0·83 of the width in these examples—a big range in a small series. Width of carapace of the four specimens in the same order is 24·9, 21, 10 and 15 mm."

In our three much smaller specimens from New South Wales the median rostral tooth is moderately obtuse, but this condition is considered to be due only to extreme youth. The length of the carapace, however (taking the specimens in order of size), is 1·06, 1·18 and 1·15 of the width.

In consideration of these facts both Mr. Hale and the writers of this paper are inclined to follow the synonymy quoted by Miers (*loc. cit.*).

In order to assist workers in the study of this perplexing species, as full a list of references as possible has been compiled.

Family XANTHIDÆ.

Genus ERIPHIA *Latreille.*

ERIPHIA NORFOLCENSIS *Grant and McCulloch.*

Eriphia norfolcensis Grant and McCulloch, Proc. Linn. Soc. N. S. Wales, xxxii, 1, 1907, p. 151, pl. i, figs. 1-1*b*.

The above species has not previously been recorded from other than its type locality—Norfolk Island, South Pacific Ocean. An interesting addition to the range is provided by three specimens from the coast of New South Wales, which agree perfectly with the three type examples in the Australian Museum.

Material.—One ovigerous female (carapace 15 mm. wide), one male (carapace 11 mm. wide), one female (carapace 11 mm. wide), from Shellharbour, New South Wales; occurring under stones in rock crevices and elsewhere between tide marks; collected by G. McAndrew, late 1923 and early 1925.

A series of nineteen specimens is also in the Australian Museum from Lord Howe Island, approximately half-way between the type locality and the source of the above record. Apparently the species is equally common on the two islands mentioned.

ERIPHIA SEBANA (*Shaw*).

(Plate lix, figs. 1-2.)

Cancer sebanus Shaw, *in* Shaw and Nodder, Nat. Misc., xv, 1803, pl. 591.

Eriphia sebana Rathbun, Bull. U.S. Fish. Comm., xxiii, pt. 3, for 1903 (1906), p. 865 (and synonymy). *Idem,* McNeill, Austr. Zoologist, iv, pt. 5, 1926, p. 309 (and synonymy). *Idem*, Ward, Austr. Zoologist, v, pt. 3, 1928, pp. 243, 244, fig. on pl. 27.

This well known and typical species of the conglomerate reef zones of Queensland's pseudo-atolls has not been recognized hitherto further south than the islands of the Capricorn Group. The present records are therefore somewhat striking in that they provide another instance of the vagaries of distribution and acclimatization.

Material.—Two male specimens (carapaces 46 and 55 mm. wide) from coast near the mouth of Richmond River, New South Wales; among rocks between tide marks; coll. A. W. O'Sullivan, who states that the species is not uncommon at the locality.

One young male specimen (carapace 22 mm. wide) from surface of rocky reef flat exposed at low tide on coast in vicinity of the breakwater at Newcastle, New South Wales; coll. Melbourne Ward, 1924.

The example from Newcastle is referable to the variety *smithii* Macleay, which is clearly defined by Alcock[17] under the name *Eriphia lævimana* var. *smithii*. Apparently there is no previous record of the variety *smithii* from Australian waters.

Genus ATERGATIS *de Haan.*

ATERGATIS OCYROE (*Herbst*).

Cancer ocyroe Herbst, Naturg. d. Krabben u. Krebse, iii, 2, 1801, p. 20, pl. liv, fig. 2. *Idem*, McNeill, Austr. Zoologist, iv, 5, 1926, p. 312 (references and synonymy). *Idem*, Ward, *tom. cit.*, v, 3, 1928, p. 244.

Although this species is known from a vast Indo-Pacific area, and is perhaps the commonest reef crab of the Queensland coasts, it has not previously been recognized further south than the islands of the Capricorn Group (McNeill, *loc. cit.*). Apparently the species is now establishing itself much further to the southward. Quite recently specimens from widely separated localities on the New South Wales coast have been acquired by the Australian Museum, and it is interesting to note that keen collectors in the past failed to meet with such a conspicuous form.

Material.—Sixteen examples from localities on the coast of New South Wales, with carapaces ranging from 6·5 mm. to 49 mm. in width: one male from coast near mouth of Richmond River, coll. A. O'Sullivan, 1924; one male from coast at Newcastle, coll. M. Ward, July, 1924; one immature juvenile from Watson's Bay, Port Jackson, coll. W. Barnes, 8th July, 1922; one male and one female from Cabbage Tree Bay (Shelly Beach), Manly, on coast north of Port Jackson, coll. M. Ward, 1924; three males and three females from Long Reef, Collaroy, on coast north of Port Jackson, coll. M. Ward, 1924; one male and three females, and one immature juvenile from Shellharbour, coll. G. McAndrew, 1923 and 1924.

Besides the above there are numerous specimens in the Australian Museum from the eastern Queensland coast, Gulf of Carpentaria, North Australia, Torres Strait, New Guinea, British Solomons, Lord Howe Island, Fiji, Japan, New Hebrides, and Ellice Islands.

Habits and Occurrence.—On the reefs of the Queensland coast the species is found sheltering under loose dead coral fragments between tide marks, and commonly wanders about in the open in areas where shallow stretches of water are left by the receding tide. The latter habit has not been observed in specimens collected on the New South Wales coast, but the crabs hide under stones high up

[17] Alcock.—Journ. Asiat. Soc. Bengal, n.s., lxvii, pt. ii, No. 1, 1898, p. 216.

in the tidal zone, where a little water remains covering patches of shell grit and sand, which are warmed by the sun after the tide recedes.

Genus CHLORODIELLA *Rathbun.*

CHLORODIELLA NIGER (*Forskål*).

Chlorodius niger Haswell, Cat. Austr. Crust., 1882, p. 62. *Idem,* Whitelegge, Journ. Roy. Soc. N. S. Wales, 1889, p. 227. *Idem,* Alcock, Journ. Asiat. Soc. Bengal, n.s., lxvii, pt. ii, no. 1, 1898, p. 160 (full refs. and syn.).

In 1882 Haswell recorded a specimen of this common tropical species from Port Jackson, New South Wales, which is still in the collection of the Australian Museum. Whitelegge later (1889) listed the species from the same locality on the authority of Haswell's record and that author's specimen. No further examples have been reported in the interim from a locality so far south, but the recent capture of further New South Wales specimens removes any doubt as to the validity of Haswell's record. The scarcity of New South Wales examples suggests that the species is only an occasional visitor to these shores, and is perhaps carried by currents from Norfolk and Lord Howe Islands, where it is firmly established.

Material.—One male from Port Jackson, N. S. Wales (carapace 16 mm. wide), Haswell's original specimen; three females from Shellharbour, on New South Wales coast south of Port Jackson (carapaces 8·5 to 12 mm. wide). Collected on rocky shore between tide marks by G. McAndrew in 1923 and 1925.

Besides numerous specimens in the Australian Museum from the tropical Australian coastline and other tropical Pacific localities, there are twenty-four examples of both sexes from Lord Howe Island in the south Pacific Ocean.

MORE NOTES ON THE MARINE MOLLUSCA OF NEW SOUTH WALES.

By

TOM IREDALE,

Conchologist, Australian Museum, Sydney.

(Plates lxii-lxv.)

The marine molluscan fauna of New South Wales was catalogued by Hedley ten years ago; since then collecting has been carried on intensively and the distribution of many species determined. Mr. A. W. O'Sullivan made collections at the Richmond River and these indicated that a rich fauna with a sprinkling of northern forms exists there and that many records will be added from that area. This is confirmed by collections made at Caloundra, Queensland, by Whitley, Mort and myself, where many northern forms were commonly found and most of which probably occur in northern New South Wales. The late Mr. G. MacAndrew searched at Shellharbour, and Master Consett Davies at Bulli, while Mr. A. J. Thackway has made collections at many places along the coast, notably at Port Stephens, regarding which a separate account may be published.

The beaches around Sydney from Palm Beach in the north to Cronulla in the south have been continually searched by Whitley, Mort, Davies, and myself, and many species regarded as rare have been found to be of common occurrence. With other officers of the Museum staff, Messrs. McNeill, Livingstone, Whitley, Boardman, and Fletcher, I investigated the marine fauna of Gunnamatta Bay, Port Hacking, and obtained a large series of soft-bodied mollusca, which it is proposed to deal with separately.

In the determination of many species it has been found necessary to discuss the range of the species throughout southern Australia and a list is being prepared embodying the results of the investigations.

PRONUCULA MAYI *sp. nov.*

An excellent figure of a *Pronucula,* identified as *P. decorosa* by May,[1] shows many differences, as May himself pointed out, so I propose to name the species *P. mayi,* the type locality being Pilot Bay, South Tasmania.

CUCULLÆA CONCAMERA (*Bruguière*).

An older name for the typical species of *Cucullæa* is *labiata* Solander,[2] but the New South Wales form so-called can be separated

[1] May.—Proc Roy. Soc Tasm, 1915, p 81, pl. viii, f 42.
[2] Solander —Catalogue of the Portland Museum, 1786, p. 185

by its oblique shape as well as sculpture detail, and is here named *Cucullæa vaga* sp. nov., the type specimen coming from 25-30 fathoms off Norah Head, New South Wales. It measures 76 mm. in length, 60 mm. in height and 51 mm. depth of conjoined valves. The sculpture of the posterior area is coarser, the hinge area is narrower, and the silky periostracum is much denser than that of the northern species.

DENTICOSA *gen. nov.*

This generic name is proposed for *Philobrya cuboides* Verco, from Backstairs Passage, South Australia, the strong teeth developed being sufficient to define the genus. Finlay[3] has published some notes I made on the dismemberment of the *Philobrya* group, showing that the type of *Hochstetteria* Velain must be the species Velain described fully, and that was *H. aviculoides*. In order to prohibit any discussion on this point I now record that this was legitimately designated as type by Kobelt.[4]

Therefore *Philobrya* must be dismissed from the New South Wales list, and *Cosa* Finlay, introduced from my notes, and *Hochstetteria* Velain will replace it, the latter for *inornata* Hedley, the former, *Cosa*, for the other three species, *parallelogramma, pectinata,* and *tatei*, all of Hedley.

PINCTADA VULGARIS (*Schumacher*).

In every case an attempt to name a shell leads in many directions, and the apparently simple task becomes a very complex problem. Thus the collection of some fine large specimens of *Pinctada* at Gunnamatta Bay necessitated their comparison with the basis of the name above cited, when much discrepancy was at once noted. Shells, apparently quite different, which I secured at the Kermadecs, had been similarly named, as had Lord Howe Island specimens, and even the Victorian shell. A number from Caloundra, south Queensland, suggested definitely that more than one species occurred there, and reference to Reeves' Monograph showed quite a long series of names available.

The name apparently best suited to the Sydney shell is *Avicula perviridis* Reeve,[5] for an Australian species collected by Strange.

Family LATERNULIDÆ.

Two species of the genus *Laternula*, formerly known as *Anatina*, are included in Hedley's New South Wales list, both described by Reeve, namely *creccina* and *prolongata*. In the Queensland list

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[3] Finlay.—Trans. New Zeal. Inst., lvii, p. 449, 1926
[4] Kobelt.—Illustr. Conchylienbuch, Lief. xi, 1884, p. 364
[5] Reeve.—Conch. Icon., x, pl. viii, sp. and f. 20, Mch., 1851.

four had been recognized, *faba* Reeve, *gracilis* Reeve, *prolongata* Reeve, and *vagina* Reeve. May allowed two in Tasmania, *creccina* Reeve (= ? *attenuata* Reeve) and *tasmanica* Reeve, and the same two had been admitted by Pritchard and Gatliff, *recta* Reeve being included as a synonym of the latter. It will be noted that all the references are to Reeve,[6] so the data may be here cited in order of arrangement.

Anatina anserifera ex Spengler, pl. ii, species 8, Dec., 1860.—Tasmania.
gracilis, sp. 9, Dec., 1860.—Moreton Bay, Australia.
marilina, sp. 10, Dec., 1860.—Australia.
creccina, sp. 12, Dec., 1860.—Adelaide, South Australia.
attenuata, pl. iii, sp. 16, Feb., 1863.—Sydney.
constricta, pl. iii, sp. 18, Feb., 1863.—North Australia.
tasmanica, pl. iii, sp. 20, Feb., 1863.—Tasmania.
faba, pl. iv, sp. 22, Feb., 1863.—Brisbane, east coast of New Holland.
recta, pl. iv, sp. 24, Feb., 1863.—Port Phillip, Australia.
vagina, pl. iv, sp. 26, Feb., 1863.—Moreton Bay, Australia.
gracilis, pl. iv, sp. 28, Feb., 1863.—Port Curtis, Australia.

(Erratum to Index, pl. iv, sp. 28.—For *A. gracilis* Reeve, read *A. prolongata* Reeve.)

Anatina laterna Lamarck was figured on pl. i, sp. 7, February, 1863, from north Australia, a different shell being regarded as *Solen anatinus* Linn., and called *Anatina subrostrata* Lamarck, sp. 6, from an unknown locality.

A good series collected at Gunnamatta showed that, while there was individual variation, differences associated with geography could be observed. For the New South Wales species Hedley's names must be rejected, *creccina* being the South Australian shell, which also occurs in north-west Tasmania: *prolongata* was introduced for Reeves' second *gracilis* and nothing like it has been seen from New South Wales, whereas shells from Shellharbour are like the first *gracilis* of Reeve, which, of course, retains its name. The figure of *marilina* is more like the Sydney "*creccina*," but, as has been suggested, it is probably a juvenile of *tasmanica*. The Sydney *attenuata* has not yet been seen by me but it certainly is not a synonym of *creccina*. Reeves' species *recta* is also not a synonym of *tasmanica*, but should be maintained, and specimens from South Australia agree fairly well with the Victorian shells. With regard to the generic name, I have shown that *Laternula* must replace *Anatina* Lamarck, and at the same place I recorded that *Anatina* Lamarck dated only from 1818 and was therefore later, not earlier, than *Anatina* Schumacher 1817, and that therefore the latter could

[6] Reeve.—Conch. Icon., xiv, Anatina, 1860-1863.

be used. As usual with vernacular names, more study necessitates readjustment, and I have found that *Anatina* Lamarck was recorded by Bosc[7] a year earlier than Schumacher, and that he wrote "Le Solen canard sert le type à ce genre." This does not make *Anatina* displace *Laternula*, but it does disqualify *Anatina* Schumacher, and allow usage of *Labiosa* "Schmidt" Möller, Möller[8] having published Schmidt's MS. substitute for *Anatina* Schumacher.

Family PERIPLOMATIDÆ.

Hedley[9] introduced a new species dredged in 75 fathoms (really 45 fathoms) off Sydney as a member of the genus *Periploma*, but the reference was merely due to a very superficial resemblance, probably following Crosse and Fischer's attachment of another Australian species to that Palæarctic genus. In the latter case Hedley had transferred Crosse and Fischer's species to another Palæarctic genus, which must also be dismissed from our fauna.

It is therefore necessary to introduce two new generic names for these species, *viz.*, *Pendaloma* for *Periploma micans* Hedley, and *Offadesma* for *Periploma angasi* Crosse and Fischer.[10] There is variation seen in the latter species when specimens from New Zealand, New South Wales, and Tasmania are contrasted, but longer series are necessary to determine its value. In the South Australian fauna occurs *Cœlodon patulus* Tate,[11] but as the generic name is invalid, a new name, *Frenamya*, is here proposed for Tate's species.

Family VERTICORDIIDÆ.

For deepwater shells of curious design the genus *Verticordia* has been brought into use, and it should be at once rejected. The name was proposed by Sowerby[12] for a fossil, and it seems unwise to class varied styles of living shells with it. Three distinct types have already been found in Australian waters, and excellent figures have already been provided by Hedley, the prickly sculptured, strongly ribbed *ericia* contrasting sharply with the smooth granose *radosa*, the hinges also differing notably. The "*australiensis*" form is even more remarkable, while the New South Wales shell so determined demands separation. I therefore introduce the new specific name *cambrica* for the shell figured by Hedley[13] from eighty fathoms off Narrabeen, which he doubtfully associated with *australiensis* Smith from off Raine Island in 155 fathoms, an almost impossible identity, which Hedley recognized. It is necessary to

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[7] Bosc.—Nouv. Dict. d'Hist. Nat., nouv. ed., i, p. 492, 1816.
[8] Möller.—Isis (Oken), 1832, col. 136.
[9] Hedley.—Rec. Austr. Mus., iv, 1901, p. 25, f. 7.
[10] Crosse and Fischer.—Journ. de Conch., xii, 1864, p. 349.
[11] Tate.—Trans. Roy. Soc. South Austr., ix, 1887-8, p. 60, pl. xi, f. 1, April, 1889.
[12] Sowerby.—Min. Conch., p. 639, 1844.
[13] Hedley.—Rec. Austr. Mus., vi, p. 303, pl. lvi, figs. 38-39, Jan. 23, 1907.

differentiate this type by the new generic name *Vertisphæra*, the New South Wales *cambrica* being selected as type.

The curious little solid granose shell (*vadosa*) with the very heavy hinge attracts attention and is evidently derived from an entirely different source from the preceding form, and the animal may prove very different indeed. I propose *Vertambitus* for the species *vadosa*, well illustrated by Hedley.[14] For the very beautiful little *ericia* the generic name *Spinosipella* is proposed, the wonderful prickly sculpture being associated with the suppression of the lunule so prominent in the preceding groups and with the compression of the hinge.

Hedley[15] described *Verticordia rhomboidea* from 100 fathoms off New Zealand, suggesting that it might fall under Dall's subgenus *Haliris*, but noting its aberrant occurrence. He[16] later corrected the specific name to *setosa*, and also added it to the New South Wales fauna from 250-300 fathoms. Examination shows that the Australian shell can be easily separated, being smaller, more convex, more numerously ribbed. It is here named *Setaliris accessa*.

Genus LYONSIELLA.

When Hedley was working out the novelties secured on his deep sea dredging trips he was always eager to refer them to already named genera with somewhat unsatisfactory results. Thus careful comparison shows the resemblances to be purely superficial, and that our shells are closely related to our fossil species, and consequently no stress can be laid upon such shell features as shape and weak teeth formation. Therefore, for the species Hedley named *Lyonsiella quadrata*[17] I propose the new generic name *Proagorina*, good figures already being given by him. The reference to the family *Verticordiidæ* is merely tentative.

Family POROMYACIDÆ.

Although Tate[18] had proposed a genus *Ectorisma*, with a specific name *granulata*, Hedley decided that the species should be relegated to *Poromya*, and, as the specific name had been previously utilized in that genus, renamed Tate's species *Poromya illevis*. The association is here rejected, and, consequently, Tate's genus must be revived, and, moreover, Tate's specific name must be reinstated.

Hedley and Petterd had previously introduced a new species dredged in 250 fathoms off Sydney as *Poromya undosa*, but that species is not congeneric with the type of *Poromya*, nor even with

[14] Hedley.—Rec Austr. Mus., vi, p. 303, pl. lvi, figs. 34-37, Jan. 23, 1907.
[15] Hedley.—Trans. New Zeal. Inst., xxxviii, 1905, p. 71, pl. ii, figs. 13-14.
[16] Hedley.—Rec. Austr. Mus., vi, 1907, p. 303.
[17] Hedley.—Rec Austr. Mus., vi, p. 302, pl. lvi, figs. 31-33
[18] Tate.—Trans. Roy. Soc. South Austr., xv, 1892, p. 127, pl. i, f. 3, 3a.

Ectorisma, and a new generic name must be proposed for it alone; it is therefore named *Qucstimya*. In this case, as in all others cited in connection with Hedley's studies, inimitable figures are always available. My late friend, in discussion on these matters, sagely remarked: "Even if my generic associations are not tenable, my figures will always hold good, and that is more important to me." Thus the non-recognition of his groupings was foreshadowed by him, and he was content to do the harder work, the complete illustration of the species secured. It must be admitted that the perfect illustration of the species has made the work of his successors very much easier than it otherwise would have been, and certainly very much easier than his own task.

Family LUCINIDÆ.

Interesting but perplexing shells are the Lucinid bivalves, and the usage of *Codakia* for many species superficially dissimilar, and *Lucinida* for three others, even less closely related, compelled study.

Codakia was proposed for the West African "Codok," and this does not correlate well with any New South Wales species, *simplex* Reeve being most like. *Jagonia* has been used for the smaller species, but it can be rejected without much trouble.

The large *rugifera* Reeve is here separated as *Pexocodakia*, the hinge being more spread out, the cardinal tooth more oblique, the muscle scars more elongate, the shell more compressed, and the sculpture much coarser. For the species known as *bella* Conrad there are many alternatives, but there also seems to be more than one species, while the following extract is quoted to illustrate one view, which, if accepted as written, would necessitate the recognition of many more "species." When describing *Codakia bella delicatula* from Riukiu I., Pilsbry[19] wrote: "Compared with *C. bella* this form is smaller, more inflated, the diameter decidedly exceeding half the length, with finer, more delicate sculpture. Typical examples of the widespread *Codakia* (*Jagonia*) *bella* Conr., occur in Japan, having been sent from Hirado, Hizen, by Mr. Hirase. It has also been reported by Dunker and others as *Lucina divergens* Phil., a name which Dall has shown to be synonymous. Reeve's *Lucina fibula* is apparently a composite of two species, but the oriental form included by him and by Adams and Reeve under that name is doubtless identical with *C. bella* Conrad." The name *bella* has been rejected recently, and this matter will be dealt with in connection with Queensland material, where greater differences are commonly seen in a series than those above indicated by Pilsbry. The New South Wales shells do not agree even with the Queensland

[19] Pilsbry.—Proc. Acad. Nat. Sci. Philad., 1905, p. 555.

ones, and a heavily sculptured form is hereafter described as *Epicodakia gunnamatta* sp. nov., the generic name being introduced to cover these small Lucinid shells such as *minima* T. Wds., *quadrata* Tate, and others. *Lentillaria* Schumacher,[20] proposed for *Venus punctata* alone, may be used for *simplex* Reeve, but these large species will be later re-examined closely, as there may be cases of convergence as in *rugifera* Reeve above separated. It may be noted that Gray[21] misspelt the name *Lenticularia*. As a representative of a very different group which has no laterals is the species Hedley[22] figured as *Codakia pisidium* Dunker and which is here renamed *Sydlorina symbolica*, the resemblance to Dunker's species being very slight, as Hedley observed. Similar species range into Queensland and also into southern Australia.

Another well known Lucinid which has no laterals is *ramsayi* Smith, which Hedley placed under *Lucinida*, a generic name applied to a very different South American bivalve. This species, *ramsayi*, is of vitreous texture, subcircular, has an impressed lunule, well defined concentric sculpture, and a small cardinal; it is here differentiated with the new generic name *Monitilora*. This also occurs in Queensland.

When Smith described *Lucina jacksoniensis* he doubtfully referred it to *Loripes* and contrasted it with "*Lucina parvula* Gould, from the same locality," this being the species I have above named *Sydlorina symbolica*. The curious feature of the "*jacksoniensis*" type of shell is the crumpled appearance, the texture being stouter, the hinge showing a strong cardinal and an obscure lateral. Hedley lately referred this species to the earlier *Loripes assimilis* Angas,[23] but Angas' description and figure do not agree. It may be remarked that Angas did not know the exact locality of his species whence his supposed New South Wales specimens were found, but added Hobson's Bay, Port Phillip. I propose the new generic name *Wallucina*, naming *Lucina jacksoniensis* Smith as type.

Still another group must be introduced for *Lucinida hilaira* Hedley, as this species is a crass shell, though of somewhat vitreous substance, has definite, though small laterals, a small cardinal, small muscle scars and irregular shape. This may be generically named *Nevenulora*. Hedley noted "Cooke erroneously cites from Port Jackson, *Lucina globosa* Forskål," and thereupon omitted the species altogether, though the shell occurs, only the name being in dispute. The shell Cooke[24] referred to is here named.

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[20] Schumacher.—Essai nouv. Syst. Vers test., 1917, pp. 49, 147.
[21] Gray.—Proc. Zool. Soc. (Lond.), 1847, p. 196.
[22] Hedley.—Proc. Linn. Soc. N.S.W., xxxix, 1914 (1915), p. 699, pl. lxxix, figs. 25-28.
[23] Angas.—Proc. Zool. Soc. (Lond.), 1867 (1868), p. 910, pl. xliv, f. 8.
[24] Cooke.—Ann. Mag. Nat. Hist., (5) xviii, 1886, p. 99.

CAVATIDENS OMISSA *gen. et sp. nov.*

(Pl. lxiii, figs. 3, 4.)

Shell small, globose, subequilateral, equivalve, umbones approximate.

Colour white. The sculpture consists of very fine, though well marked growth lines, no radials being present. Lunule simply impressed. The hinge shows no teeth, only a long thin internal ligament. Muscle scars well marked, the anterior elongate, pallial line continuous.

Length.—20 mm.; height 18 mm.; depth of single valve 8 mm.

Habitat.—New South Wales. Type from Gunnamatta Bay, Port Hacking. This is one of the toothless Lucinids which have been called *Loripes* or *Cryptodon*, and many species have been confused through this lack of teeth. It appears obvious from comparison of many specimens that these toothless forms are degenerates from toothed shells, and have no close relationship. This matter will be dealt with in connection with Queensland mollusca, in which very different shells have been brought together merely on account of a toothless hinge.

EPICODAKIA GUNNAMATTA *sp. nov.*

(Pl. lxiv, figs. 6, 7.)

Shell small, rather obese, solid, subcircular, subequilateral, lunule well impressed. Colour dirty white, umbones yellowish. The sculpture consists of well marked radials spreading a little laterally, and is concentrically very closely wrinkled, growth stages being strongly marked. Internally dirty white, the muscle scars prominent, anterior elongate. Hinge shows deeply sunk ligament pit, and small but strong cardinal, strong laterals, distant, deep lunule intervening on anterior side. The radials on the immature shell number about twenty-five, but increase with age to between sixty and eighty.

Length.—22 mm.; height 21 mm.; depth of single valve 9 mm.

Habitat.—New South Wales. Type from Gunnamatta. Some specimens are not so strongly sculptured and may be referable to another species; series have been collected for study in that direction.

EPICODAKIA CONSETTIANA *nom. nov.*

This name is introduced for *Lucina minima* Ten. Woods,[25] which has been well figured by May,[26] and which must be added to

[25] Ten. Woods.—Proc. Roy. Soc. Tasm., 1875 (1876), p. 162.
[26] May.—Proc. Roy. Soc. Tasm., 1902 (1903), p 114, fig. 12 in text.

the New South Wales fauna. Master Consett Davis found this species at Bulli and separated it from *quadrata* Angas, with which species it had been confused previously.

BATHYCORBIS *gen. nov.*

This name is introduced for the deepwater shell Hedley[27] described as *Chione despecta,* and afterwards transferred to *Corbis,* but it has little to do with that huge coral-dwelling mollusc.

Family THYASIRIDÆ.

One by one the species credited with world-wide distribution have been studied with the same result, and a species that had apparently defied disruption was *Thyasira flexuosa* Montagu, a British shell which appeared in Hedley's New South Wales List. Examination has shown that it had probably the smallest claim of any to recognition as a widely distributed species, as the figures hereafter given will prove. Apparently Brazier[28] is responsible for the introduction of this species to the Australian list, when he identified specimens from off Port Stephens with the British shell, and added South Tasmania as a locality, also observing: "The three well-known varieties, *rotunda, polygona,* and *sarsii,* are found off the New South Wales coast." That remark alone is sufficient to query the determination, as those varieties do not occur together in one locality in the Northern Hemisphere, and as far as I can trace Brazier had not specimens for criticism.

Examination of series from New South Wales shows two species to have been confused and these are referable to two distinct genera, judging from shell features, and it may be observed that the animals of the Palæarctic forms differ, though showing only slight shell discrepancies. The South Australian shell is still more different and consequently three species are here described, and there are probably others yet to be recognized.

The little shell Hedley[29] named *Thyasira albigena,* which he suggested might be referred to the subgenus *Axinulus*, can be at once separated as the type of a distinct genus, *Genaxinus.*

PARATHYASIRA RESUPINA *gen. et sp. nov.*

(Pl. lxiii, fig. 5.)

Shell small, thin, inequilateral, equivalve, umbones touching, subcircular, anterior side nearly straight enclosing a deep, long ligamental pit, ligament semiexternal; posterior side concave with an ill-defined elongate lunule; ventral margin rounded; a double

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[27] Hedley.—Proc. Linn. Soc. N.S.W., xxix, 1904, p. 193, pl. 10, figs. 35-38.
[28] Brazier.—Proc. Linn. Soc. N. S. Wales (2), ix, 1894, p. 725.
[29] Hedley.—Rec. Austr. Mus., vi, 1907, p. 363, pl. lxvi, fig. 45.

very shallow fold present. Sculpture of very fine radial lines, with a delicate brownish silky periostracum present. Dead shell translucent, muscle scars indistinct. Hinge toothless.

Length.—5·5 mm.; height 5·5 mm.; depth of conjoined valve 3·5 mm.

Habitat.—New South Wales. Type from 63-75 fathoms off Port Kembla, New South Wales. This genus also occurs in Neozelanic waters, a specimen being in this Museum from 110 fathoms off Great Barrier Island; this specimen is much larger, measuring 9 mm. × 9 mm., and the radial sculpture is missing, the concentric growth lines becoming more noticeable; this may be called *Parathyasira resupina neozelanica* subsp. nov. until longer series are secured.

Prothyasira peroniana *gen. et sp. nov.*

(Pl. lxiii, fig. 8.)

Shell small, thin, translucent, inequilateral, equivalve, convex, height greater than width, anterior side deeply triply sinuate, ventral rounded, posterior straight, a little incurved, a broad excavate lunule present. The folds are very deep and the ligament socket thin and practically internal, a small cardinal being developed in the right valve. No radial lines present but indistinct radial waves can be distinguished anteriorly and posteriorly. Muscle scars indistinguishable.

Length.—5 mm.; height 6 mm.; depth of single valve 3 mm.

Habitat.—New South Wales. Type from 63-75 fathoms off Port Kembla, New South Wales. This genus also occurs in New Zealand, specimens sent by Suter from 18 fathoms, Stewart Island, being of this style, smaller, more circular, folds less deep, lunule shallower and cardinal less developed; height 5·5 mm., length 5 mm. This may be called *Prothyasira peroniana peregrina* subsp. nov.

Prothyasira adelaideana *sp. nov.*

(Pl. lxiii, figs. 6-7.)

Shell large for the genus, thin, very inequilateral, equivalve, convex, height greater than length, anterior side triply sinuate, ventral rounded, posterior incurved and folded, lunule comparatively short and deep. The folds are deep, but not so deep as in preceding, ligament socket broad, no cardinal present. Growth lines constitute the only sculpture save a couple of obsolete distant waves parallel to the folds. There is a fold succeeding the lunular area, a feature absent in the preceding species. Through the much larger size of the shell the muscle scars can be clearly seen.

Length.—15 mm.; height 18·5 mm.; depth of single valve 6 mm.

Habitat.—South Australia. Type dredged in 100 fathoms 40 miles south of Cape Wiles.

This is a fine species and is easily recognized by the shortness of the unfolded side, where, however, a fold is developing. Apparently in these animals there is a tendency to develop folds throughout, as there is a succession of folds more or less deep in the series here described. Another species, which will be figured later, shows the distant waves observed in the above, much more developed and practically secondary folds, the post-lunular fold also being present. This shell is flatter, thinner, and the ventral edge is sinuate, showing the wave formation. No cardinal tooth is present and the ligamental socket is almost marginal. The height is 12 mm.; length 11 mm.; depth of conjoined valve 4 mm. This may be called *Prothyasira benthicola* sp. nov., the shell coming from 470 fathoms 33 miles east by south from Green Cape, New South Wales.

VIRMYSELLA SPERNAX *gen. et sp. nov.*

(Pl. lxiv, figs. 10-12.)

Angas[30] described *Mysella anomala* and, introducing a new genus, he gave a good figure. For some unknown reason this figure was depreciated, and the present species, common as valves on the Sydney beaches, was determined as Angas' species, which, however, was dredged in Sydney Harbour in 12 fathoms on a muddy bottom, where it still occurs.

Shell small, rather solid, inequilateral, equivalve, longer than high, rather flattened. Colour white. Sculpture consists of growth lines only. Anterior side a little truncate, straight, posterior rounded, ventral rounded. Hinge with a deep ligament socket and a projecting sharp cardinal.

Length.—14 mm.; height 10 mm.; depth of single valve 3 mm.

Habitat.—New South Wales. Type from Manly. Common as valves on all the ocean beaches round Sydney.

MERIDOSINIA NEDIGNA *gen. et sp. nov.*

(Pl. lxiv, figs. 4-5.)

A not uncommon little Dosinid was collected at Gunnamatta and valves of the same species have been found on the Sydney beaches. It may have been regarded as *scabriuscula* Philippi,[31] but has little to do with it, and, moreover, Philippi's shell was described from Loandá.

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[30] Angas.—Proc. Zool. Soc. (Lond.), 1877, p. 176, pl. 26, f. 22.
[31] Philippi.—Abbild. Beschr. Conch. ii, p. 229, pl. 6, f. 2.

Shell small, solid, subequilateral, equivalve, white, subcircular, somewhat compressed, lunule small, narrow, rather deeply sunk, escutcheon long, defined by a definite ridge. Colour creamy white. Sculpture consists of flattened closely set ridges, eighty to a hundred in number, the juvenile area showing the ridges still regularly. Hinge strong, rather narrow, muscle scars large, pallial sinus medium, angulate, and almost horizontal, pallial line very short.

Height 26 mm.; length 26 mm.; depth of conjoined valves 15 mm.

Habitat.—New South Wales. Type collected at Gunnamatta.

SUNETTINA *Jousseaume.*

I concluded[32] that *Sunettina* Jousseaume could be used generically for the Australian species previously classed under *Sunetta.* This was following Dall,[33] who had proposed *Solanderina* for *S. solandri* Gray, and allowed Jousseaume's name as valid. Looking up Kobelt's Illust. Conchylienbuch in another connection, I was amazed to see the name *Sunettina,*[34] and, reading, found that he quoted the name as of Pfeiffer, introduced for *S. solandri* Gray. The name does not appear in any nomenclator or record as of Pfeiffer or Kobelt, but undoubtedly the name is valid and will replace *Solanderina* Dall, and invalidate *Sunettina* Jousseaume.

I therefore propose *Sunemeroe* gen. nov., naming *Sunetta adelinæ* Angas[35] as type.

Genus ANTIGONA.

Under this generic name eight species were recognized in Hedley's New South Wales List, *viz.*, *A. chemnitzii* Hanley, *A. laqueata* Sowerby, *A. lamellaris* Schumacher, *A. gallinula* Lamarck, *A. lagopus* Lamarck, *A. marica* Linné, *A. scabra* Hanley, and *A. striatissima* Sowerby. I[36] showed that the correct name of the last named was *cardioides* Lamarck, and introduced a distinct generic name, *Chioneryx,* for it.

The type of *Antigona* is *lamellaris* Schumacher, but the species so called in New South Wales differs from the tropical Queensland one, which would be nearer the typical form in shape and detail of sculpture, and may be called *A. lamellaris moderata* subsp. nov., the height being more in proportion to the length, the concentric ridges less developed, and the radials less numerous, the escutcheon more marked, the lunule shorter.

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[32] Iredale.—Proc. Linn. Soc. N. S. Wales, xlix, 1924, p. 209
[33] Dall.—Proc. U.S. Nat. Mus., xxvi, 1902, p. 350.
[34] Kobelt.—Illustr. Conchylienbuch, 10th lief., p. 335, pl. 98, f. 17, 1883.
[35] Angas.—Proc. Zool. Soc. Lond., 1867 (1868), p. 909, pl. 54, f 5.
[36] Iredale.—Proc. Linn. Soc. N. S Wales, xlix, 1924, p. 210.

When he proposed *Periglypta*, with type *puerpera* L., Jukes-Browne[37] wrote: "Two other species, *V. laqueata*, Sow., and *V. chemnitzi*, Hanley, differ from all the rest in the following particulars: they have smooth nymphs, a small angular sinus, and the pedal scar is confluent with that of the adductor." Probably, as in many other cases, he was only writing about the traditional identification of the species and thus errors may be magnified. I have already described[38] the Sydney shell known as *laqueata* Sowerby as a distinct genus and species, *Proxichione materna*, and I now propose to separate the species known as *chemnitzii* under the new generic name *Tigammona*, the new species *T. persimilis* being named as type. It may be noted that these groups appear among the known fossils of southern Australia, with scarcely any differentiation. Thus Pritchard many years ago described a shell obviously the ancestor of my *P. materna*.

TIGAMMONA PERSIMILIS *gen. et sp. nov.*

(Pl. lxii, figs. 1-2.)

Shell small for this series, elongate, oval, inequilateral, equivalve, anterior side produced, straight, posterior short, sloping, ventral shallowly rounded. Colour white, rayed with brown splashes, rays massing on the anterior side, lunule brown, elongate, narrow, escutcheon long, narrow.

Sculpture, concentric upstanding ridges, coarser laterally, latticed by radial ribs, which become more pronounced on the anterior slope; the ridges number about thirty, not counting the closely set umbonal series. At the ventral edge they are duplicated, indicating rest periods and adult age; the radials number about fifty, the interstices wider than the ribs, and all over-run with very fine concentric striation; the lunule is radially rayed as is also the escutcheon. The hinge is long and narrow, the teeth proportionately strong, the muscle scars large, the pallial sinus subangulate, the ventral edge minutely denticulate.

Length 31 mm.; height 23·5 mm.; depth of single valve 10 mm.

Habitat.—New South Wales and south Queensland. Type collected on Manly Beach, New South Wales.

This is more elongate than the so-called *chemnitzii* of our beaches, and is apparently full grown, whereas *chemnitzii* grows to 60 mm. and more in length; the brown lunule is distinctive, while the pallial sinus is less angulate and comparatively larger.

[37] Jukes-Browne.—Proc. Malac. Soc. Lond., xi, p. 72, 1914.
[38] Iredale.—Austr. Zool., v, 1929, p. 339.

VEREMOLPA ETHICA *gen. et sp. nov.*

(Pl. lxii, figs. 3-4.)

The little shell, known as *Antigona scabra* Hanley[39] in New South Wales, differs at sight from the Philippine Islands shell in proportions and detail of sculpture. It is obviously not referable to *Antigona* in a broad sense even, so is here introduced with a new generic name.

Shell very small for this series, inequilateral, inequivalve, a little swollen, anterior side produced, sloping, meeting the ventral edge, which is rounded somewhat angularly, posterior side short, straight, rather roundly truncate, lunule large, concentrically ribbed, escutcheon missing.

Colour creamy white, umbonal area purplish, interior pale purplish brown, ventral edge cream.

Sculpture consists of distant concentric ridges, about twenty in number, the umbonal striæ not counted; these are subordinated to the radials, which are thick, with narrow interstices. About twenty clearly defined rays can be discerned on the juvenile shell, but these split into two, three, or four as the shell grows, so that fifty to sixty may be counted at the ventral margin. Internally the ventral margin is correspondingly denticulate, but the anterior and posterior sides are minutely crenulaté. The muscle scars are comparatively very large, the pallial sinus short and rounded; the hinge teeth are compressed, with no sign of an anterior lateral.

Length 12 mm.; height 10 mm.; depth of conjoined valves 8 mm.

Habitat.—New South Wales and South Queensland. Type from Port Stephens, New South Wales.

ARCOPAGIA STRIATULA *Lamarck.*

I[40] drew attention to the fact that this name could not be maintained but offered no alternative, as I had been unable to examine local shells attributed to the species. I have now seen specimens attributed to the species by Brazier, who added it to the New South Wales list, and find these are referable to *Pseudarcopagia botanica* Hedley, the fine radial striæ being obsolete. The name can now be altogether dismissed. While investigating this matter I examined the species *Tellina subelliptica* Sowerby,[41] which Hedley had also referred to *Arcopagia,* and find a curious little Tellinid, showing no resemblance to any species otherwise referred to *Arcopagia.* The hinge is similar to that of *Pinguitellina* as figured by me,[42] but the pallial sinus differs as well as the texture. It does not agree with

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[39] Hanley.—Proc. Zool Soc. (Lond.), 1844, p. 161
[40] Iredale.—Proc. Linn Soc. N. S. Wales, xlix, 1924, p. 211.
[41] Sowerby.—Conch. Icon. xvii, 1867, pl. xxxix, f. 220.
[42] Iredalè.—Rec. Austr Mus., xvi, 1927, pl. v, f 8.

Pseudarcopagia as figured by Hedley,[43] so is here distinguished with the new generic name *Punipagia*.

Deltachion virilis *gen. et sp. nov.*

(Pl. lxii, figs. 5-6.)

When Smith[44] described *Donax brazieri* from the Richmond River, New South Wales, he added that trigonal specimens were also met with. On Manly Beach trigonal shells are not uncommon, and, traditionally identified, they were regarded as typical until Mr. A. W. O'Sullivan brought some shell grit from the Richmond River, and elongate shells were sorted out. The shells were fairly common and the elongate shells were regarded as novel until the original account was criticised, when it was found that this is not the case. From the Sydney beaches only the trigonal species is found, and from the north of New South Wales and South Queensland both species occur together. The northern Queensland shells will be dealt with later, but in South Australia occurs a fine species which has been regarded as *brazieri*, but which is very easily differentiated.

This group of species is obviously separable from the southern *Donax deltoides* series which does not agree with the type of *Donax*, nor with *Chion*. The only correct method of nomination is the introduction of generic names for the Donacoid series in Australian waters, and I therefore name the *brazieri* series *Deltachion*, selecting *D. virilis* as type. At the same time I propose *Plebidonax* gen. nov., for the *deltoides* group, and *D. veruinus* Hedley must be named *Tentidonax* gen. nov. as it is most aberrant; the elongation of this last-named at first sight conceals its Donacoid affinity, while its hinge is similarly spread. The genus *Deltachion* is formed for small Donacoid shells with abruptly truncate posterior side, strongly keeled; cardinal tooth bifid, anterior lateral distant, posterior lateral approximate; ligament rather small, external, pallial sinus very large, extending three-quarters the length of the shell and more than half the depth. The genus *Plebidonax* comprises large shells, the posterior side obsoletely keeled and less truncate; cardinal tooth massive, bifid in right valve, two cardinals in left valve, anterior lateral obsolete, posterior lateral distant, ligament external, sunken, very large; pallial sinus large but extending only half-way across and less than half the height of the shell; sculpture on posterior portion weak.

The species *Deltachion virilis* may be described thus: Shell small, trigonal, nearly equilateral, equivalve, posterior side angularly truncate, anterior side produced. Colour pinkish white, tinged towards the umbones with purple; interior white with dull purplish

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[43] Hedley.—Proc. Linn. Soc. N. S. Wales, xlviii, 1923, pl. xxxi, figs. 17-18.
[44] Smith.—Proc. Zool. Soc. (Lond.), 1891, p. 491, pl. 40, f. 10.

blotches at times. The sculpture consists of grooves obsolete anteriorly but becoming pronounced towards the posterior angle; on the posterior side they are very marked and crossed with fine radials more developed near the umbonal region; these lines cause a crenulation along the posterior angle. Ventral edge gently rounded, markedly denticulate within. Hinge very compressed; pallial sinus very large.

Length 15 mm., height 13 mm., depth of single valve 5 mm.

Habitat.—New South Wales and south Queensland. Type from Manly Beach, New South Wales.

A topotype of *D. brazieri* Smith is figured for comparison (pl. lxii, fig. 8) when the differences are seen to be that the typical *brazieri* is altogether more elongate, with less height, and shorter posterior side; the sculpture is also less marked posteriorly.

The South Australian shell differs in size and shape, the swelling of the ventral edge being a notable feature.

DELTACHION ELECTILIS *sp. nov.*

(Pl. lxii, fig. 7.)

Shell larger than preceding, more flattened, posterior angle less pronounced, anterior side more produced and ventral edge swollen medially. Colour creamy white, sometimes with pinkish rays. Sculpture less developed but of exactly the same nature, the posterior angle not crenulate and the posterior side a little more extended. Internally there is sometimes a dull purple blotch on the otherwise white interior; ventral edge strongly denticulate.

The hinge is a little more spread out and the pallial sinus is not so rounded and comparatively shorter and less deep.

Length 20 mm., height 15 mm., depth of conjoined valves 8 mm. Valves of larger size have been seen.

Habitat.—South Australia. Type from St. Vincent's Gulf. Apparently the same species occurs in south-west Australia, but a different one in north-west Australia.

MACTROID SHELLS.

Six species of *Mactra* and one of *Spisula* are recognized by Hedley under the names *M. contraria* Reeve, *M. eximia* Reeve, *M. jacksonensis* Smith, *M. ovalina* Lamarck, *M. parkesiana* Hedley, *M. pusilla* Adams, and *S. trigonella* Lamarck. In order to determine the species of *Mactra* it was necessary to review the whole of the Australian species, and some conclusions have already been published[45] in connection with Queensland forms. The southern

[45] Iredale.—Mem. Queensland Mus., ix, 1929, pp. 267-8.

Australian species offer different problems and a preliminary regrouping of the species is here proposed, and new generic names are here introduced, the generic name *Mactra* belonging to a Palæarctic species not comparable with our forms, while *Spisula* is even less related to the southern species. One of the best known groups is typified by the species known as *contraria* in New South Wales and *rufescens* in southern Australia. The generic name *Austromactra* is proposed to cover the series, and the south Queensland species is hereafter described as *A. caloundra.* A series of small shells with a different hinge is here named *Nannomactra,* the type being *Mactra jacksonensis* Smith[46] who has well figured and described the hinge.

Another series is represented by the shell Hedley described as *Mactra parkesiana* and the hinge was also well figured and described.[47] The adult of that species differs in shape and will be figured in a later communication, but the genus is here named *Electomactra.* The species commonly known as *Mactra ovalina* Lamarck, but which is not Lamarck's species, and which is described and figured hereafter, belongs to this genus.

A very curious little Mactroid species living in South Australia has also been well figured, and the hinge described, and it is only necessary to introduce the generic name *Diaphoromactra* for it, the sole species being Tate's *H. versicolor.*[48]

Under the name *Spisula parva* Petit, Hedley arranged a series of names, regarding the forms, which had been differentiated as only individual varieties. An earlier name, *trigonella* Lamarck, was found to refer to this style of shell, and was therefore preferred. There can be no doubt that more than one species is represented locally, and, moreover, geographical variation is evident. Consequently *trigonella* can again be rejected, as Lamarck described this from King George's Sound, West Australia. For the small trigonal form Petit's name *parva* can be revived, while Angas'[49] *cretacea* can be used for the second species, which was later named *fluviatilis* by the same author,[50] both figures being quite characteristic. The two species *parva* and *cretacea* can be collected in Port Jackson, and are easily separable. A name for the Sydney form of *parva* was given by Angas, *viz., producta,* in the earlier paper quotation above. It is even possible that the two species are not congeneric, but for the present they may be classed together under the new generic name *Notospisula,* the type being named as Petit's species.

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[46] Smith.—Rep. Sci. Res. Challenger, xiii, 1885, p. 62, pl. 5, figs. 9*a*-*b*.
[47] Hedley.—Proc. Linn. Soc. N. S. Wales, 1902, p. 8, pl. i, figs. 5-9.
[48] Tate —Trans. Roy. Soc. South Austr., ix, 1885-6 (Mch., 1887), p. 64, pl. iv, f. 12.
[49] Angas.—Proc. Zool. Soc. (Lond.), 1867 (1868), p. 909, pl. xliv, f. 6.
[50] Angas.—Proc. Zool. Soc. (Lond.), 1871, p. 20, pl. i, f. 31.

AUSTROMACTRA CALOUNDRA *sp. nov.*

(Pl. lxiii, figs. 1-2.)

Shell fairly large, crass, almost equilateral, equivalve, longer than high, posterior side nearly straight, forming a subacute angle with the ventral edge, which is regularly and shallowly rounded; anterior side a little swollen medially, otherwise very like the posterior, the angle of junction with the ventral side being less acute.

The sculpture consists of well marked ridges developing after a smooth umbonal region has been formed; these ridges are closely packed, becoming wavy laterally, very pronounced on the lower edges. Colour is brownish, and young shells have a couple of broad rays of purple, which colour sometimes tinges the interior. The hinge is broad and the pallial sinus small and rounded.

Length 52 mm., height 39 mm., depth of single valve 14 mm.

Habitat.—South Queensland and northern New South Wales. Type from Caloundra, South Queensland.

ELECTOMACTRA ANTECEDENS *sp. nov.*

(Pl. lxiv, figs. 1-3.)

Shell of medium size, elongate oval, inequilateral, equivalve, thin, vitreous, white. Anterior side produced, straight, meeting the ventral edge roundly, the latter being gently arcuate, the posterior side straight, angulate, a notable keel being formed. Sculpture consists of growth lines only, the umbones being smooth; indistinct suggestion of radials appears laterally, more marked on the posterior angulate side. The hinge plate is broad and agrees with that described by Hedley for his *M. parkesiana,* the type of the genus *Electomactra.* The sinus is short and rounded.

Length 42 mm., height 28 mm., depth of single valve 8 mm.

Habitat.—New South Wales and south Queensland. Type from Gunnamatta. This is the species commonly known locally as *Mactra ovalina* Lamarck, but which does not agree with Lamarck's species, as has already been pointed out by Reeve, Smith, and Hedley.

ZENATIA VICTORIAE *Pritchard and Gatliff.*

This Victorian species was admitted by Hedley from Twofold Bay, while he rejected Angas' record of *Zenatia acinaces* from Botany Bay. The species was found by Master Consett Davis to be very common at the mouth of the Richmond River, and Mort collected it at Coff's Harbour and Byron Bay. This instigated comparison with Victorian specimens, when they were all found

to be referable to *Zenatiopsis* Tate,[51] although I could not separate the northern shells from the southern ones.

This is an interesting correction as showing the selective endemism of our molluscan fauna, the genus *Zenatia* being founded on a Neozelanic species, while *Zenatiopsis* was provided for Australian fossils, and the recent Australian shells are indubitably congeneric with the fossils and not with the Neozelanic recent shells, the distinguishing features being easily recognized.

Family AMPHIDESMATIDÆ.

Two species of *Amphidesma* and one of *Ervilia* are included in Hedley's list, but the nomination needs readjustment with the addition of another species.

To treat the small shell regarded as *Ervilia bisculpta* Gould first, it may be remarked that it does not bear much resemblance to the Palæarctic type of *Ervilia,* it does not seem to be conspecific with the Japanese species, and it has a specific name founded on the Sydney shell. Therefore, while reviving the latter, I introduce a new generic name *Spondervilia,* naming *Ervilia australis* Angas as type. Hedley[52] has given good figures of the Queensland species, which may differ. The two species classed under *Amphidesma* are *angusta* Reeve and *cuneata* Lamarck, the latter described from Kangaroo Island, South Australia; local specimens disagree in shape and may be named *Amesodesma cuneata vanidica* subsp. nov., the posterior side being more produced, the ventral much more rounded, the pallials sinus smaller.

Length 26 mm., height 19 mm. Type from Gunnamatta, New South Wales.

AMESODESMA PERFUGA *sp. nov.*

(Pl. lxiii, fig. 9.)

Shell small, rather thin, elongate, very inequilateral, equivalve, anteriorly very produced, posteriorly somewhat truncate, ventral edge a little sinuate. Colour white, rather translucent. Sculpture consists of fine growth lines only. Confused with *angusta* Reeve it differs in its tenuity, Reeves' species being very solid with the posterior edge abruptly truncate, and the ventral edge nearly straight; the latter has been well figured by Hedley.[53] Owing to the elongation of the posterior side the hinge is more spread and the pallial sinus does not reach below the median ligament as in Reeves' species.

Length 22·5 mm., height 10 mm.

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[51] Tate—Trans. Proc. Philos. Soc. South Austr., ii, 1879, 129.
[52] Hedley—Proc. Linn. Soc. N. S. Wales, xxxi, 1906, p. 479, pl. xxxvi, f. 8.
[53] Hedley—Proc. Linn. Soc. N. S. Wales, xli, 1916 (1917), p. 692, pl. xlvi, f. 4.

Habitat.—New South Wales. Type from Gunnamatta. This species appears to live in deeper water than *angusta* and frequents the inland waters in preference to the ocean beaches, whence alone the latter has been secured.

Family MYACIDÆ.

To this family Hedley allotted two species, referring them to the genera *Cryptomya* and *Turquetia*. Each was a very dubious association. *Cryptomya* had been introduced by Conrad for an American shell, not much like ours, which has been well figured by Hedley,[54] so that it is only necessary to introduce a new generic name *Venatomya* for A. Adams' *Sphænia elliptica*.

When Hedley introduced the new species *integra* for a species dredged in 250 fathoms off Sydney, he doubtfully included it in the genus *Turquetia*, which had been proposed by Velain for a shallow-water subantarctic bivalve. As such tentative determinations are very often cited by workers as confirmation of hypotheses and theories to the detriment of scientific progress, it seems best to dissociate this species and propose for it the new generic name *Benthoquetia*, an excellent figure and description having been provided by Hedley.

Family CORBULIDÆ.

Two species are included in Hedley's New South Wales list, *smithiana* Brazier and *tunicata* Hinds. Of the former, *coxi* Pilsbry was ranked as a synonym, but a long series of specimens from Twofold Bay justifies its reinstatement as a distinct species. Quite a different species was dredged off Gabo Island by Roy Bell, and a few specimens were found in Twofold Bay, New South Wales. This was found to agree with shells from Port Albert, Victoria, determined as *scaphoides* Hinds, while both *scaphoides* and *tunicata* appear in Hedley's Queensland list. Lots of specimens were available, for when these molluscs are dredged numbers are always secured, as they are gregarious in mud. The Queensland shells marked as *scaphoides* were obviously distinct from the true *scaphoides*, but at first sight our "*tunicata*" appeared to agree with the figure of *tunicata*; closer examination, however, showed that the New South Wales shell was nearer than the Queensland one which showed at once that both were different, as Hind's species was from the Philippine Islands. It became, therefore, necessary to name the three species confused in eastern Australia under the name *tunicata*, and owing to the confusion it seemed best to explain the differences clearly by means of figures and with the excellent illustrations here provided distinction should be very easy.

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[54] Hedley—Proc. Linn Soc N S. Wales, xxxviii, 1913, p 275, pl 17, figs 40-44.

The generic name *Corbula* has been a source of trouble recently; its introduction was very irregular and must be here explained. The first time *Corbula* appeared in binomial literature was among the plates in the Encyclopédie Methodique, on plate 230, supposed to have been published in 1797; no specific names occur. The genus was included by Lamarck[55] in his 1799 issue with a simple reference to this plate but still no specific names. In 1801 he added names for the figures, but selected no type nor did he indicate such in any way.

In 1847 Gray[56] selected as type *Corbula sulcata*, but, as Megerle in 1811[57] had introduced *Aloidis* for this species, some authorities have rejected Gray's designation and regarded *gallica* as the type. Fischer[58] stabilized the matter by introducing *Bicorbula* for the *gallica* series. This is so straightforward that it will be at once asked, whence the trouble? In 1798 Bolten used *Corbula* in a perfectly legitimate manner for a series of molluscs none of which were *Corbula* in the Lamarckian sense, and Bolten's usage is the first one where specific names are given. Under these circumstances I designate as type of *Corbula* Bolten, *Corbula rosea*, and that will reduce *Corbula* Bolten to the synonymy of *Asaphis* Modeer. If *Corbula* Bruguière be disregarded the name will disappear, and I, therefore, introduce *Notocorbula* with *N. vicaria* Iredale as type for the southern Australian species with the cardinal tooth keeled, a feature I have not seen remarked upon elsewhere. Another extraordinary form which is commonly referred to *Corbula*, is the Queensland shell known as *Corbula macgillivrayi* Smith. It is difficult at first sight to recognize its relationship with the southern species, and it is therefore here nominated as the type of a new genus, *Anisocorbula*, the elongate subequivalve form being very striking and quite unlike that of any of the named groups of this family.

Notocorbula vicaria *sp. nov.*

(Pl. lxv, figs. 3, 4, 9; Pl. lxiv, figs. 8-9.)

Shell small, crass, semiglobose, right valve very convex, clasping the left valve which is less swollen, umbones approximate, beak or snout short and stout. Colour white.

Right valve very closely concentrically ribbed, posterior side keeled, posterior area less strongly sculptured, radial ornamentation obsolete. The juvenile shell is differentiated in a cap-like fashion, comparatively more elongate than mature shell, and notably keeled and sculptured with about twelve liræ crossed by minute radial

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[55] Lamarck.—Mem. Soc. N. H. Paris., p. 89, 1799: Syst. Anim., 1801, p. 137
[56] Gray.—Proc. Zool. Soc. (Lond.), 1847, p. 191.
[57] Megerle.—Ges. Nat. Fr. Berl. Mag. v, 1811, p. 67.
[58] Fischer.—Man. de Conch., 1887, p. 1123.

threads, the umbonal area being minutely reticulate. Succeeding the cap about twenty-three to twenty-five ridges may be counted, the ridges somewhat angulate. Left valve shows a similar flattened juvenile shell, but the remainder of the valve is covered with closely packed, rough, brown periostracum showing no concentric ridges but two or three radial elevations. Snout a little twisted, elongate.

Length 23 mm.; height 17 mm.; depth of conjoined valves 14 mm.

Habitat.—New South Wales. Type from Sydney Harbour.

NOTOCORBULA HYDROPICA *sp. nov.*

(Pl. lxv, figs. 5-6, 8.)

Compared with preceding, this species is even more globose, both right and left valves being more convex and snout more pronounced. The juvenile shell is more elongate, more regularly sculptured, keel more pronounced, and dorsal area more regularly lirate. The mature shell has fewer and bolder concentric ridges on the right valve, fifteen being counted as compared with twenty-three, while the concentric ridges show a little underneath the periostracum of the left valve, and the radials are also more notable.

Length 23 mm.; height 15·5 mm.; depth 15·5 mm.

Habitat.—North Queensland. Type from Albany Passage. Smith[69] has given a figure under the name *C. scaphoides* Hinds, which appears to have been drawn from a Torres Strait specimen.

NOTOCORBULA STOLATA *sp. nov.*

(Pl. lxv, figs. 1-2, 7.)

Differs at sight from the Sydney species in its smaller size, much less swollen shape and obsolete snout. The juvenile shell is correspondingly larger, weakly sculptured, being finely concentrically lined, with the radials evanescent, less elongate, and more strongly keeled. The mature sculpture of the right valve consists of about eleven flattened rounded ridges separated by cuts only, not deep grooves, while the left valve shows a more regularly concentric periostracum.

Length 16·5 mm.; height 12 mm.; depth of conjoined valves 9 mm.

Habitat.—Victoria and southern New South Wales (Twofold Bay). Type from Port Albert, Victoria.

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[69] Smith.—Rep. Sci. Res. Challenger, Zool. xiii, 1885, p 32, pl. vii (not viii), figs. 3a-b.

This species resembles some fossil specimens, referred to *C. ephamilla* Tate, but obviously more than one species is included under that name; the fact, however, is interesting in confirmation of the local endemism of our marine fauna.

Family SAXICAVIDÆ.

This name must be emended to *Hiatellidæ* as the generic name *Saxicava* Bellevue must be rejected in favour of *Hiatella*. These generic names have always been regarded as synonymous, and the dates of publication prove to be as follows:

Saxicava Bellevue, Journ. Physique, liv, p. 5, 1802.

Hiatella Bosc., Hist. Nat. (Buffon), ed. Deterville, Moll. iii, 120, 1801.

The excellent illustrations to this paper are from paintings made by Miss J. K. Allan, of this Museum, and my best thanks are here tendered for this assistance which facilitates the recognition of the species discussed.

The new names introduced in this paper are:

Pronucula mayi sp. nov.
Cucullæa vaga sp. nov.
Denticosa gen. nov.: type *Philobrya cuboides* Verco.
Pendaloma gen. nov.: type *Periploma micans* Hedley.
Offadesma gen. nov.: type *Periploma angasi* Crosse and Fischer.
Frenamya gen. nov.: type *Cœlodon patulus* Tate.
Vertisphæra gen. nov.: type *Vertisphæra cambrica* Iredale.
Vertisphæra cambrica sp. nov.
Vertambitus gen. nov.: type *Verticordia vadosa* Hedley.
Spinosipella gen. nov.: type *Verticordia ericia* Hedley.
Setaliris gen. nov.: type *Verticordia setosa* Hedley.
Setaliris accessa sp. nov.
Proagorina gen. nov.: type *Lyonsiella quadrata* Hedley.
Questimya gen. nov.: type *Poromya undosa* Hedley and Petterd.
Perocodakia gen. nov.: type *Lucina rugifera* Reeve.
Epicodakia gen. nov.: type *Epicodakia consettiana* Iredale.
Sydlorina gen. nov.: type *Sydlorina symbolica* Iredale.
Sydlorina symbolica sp. nov.
Monitilora gen. nov.: type *Lucina ramsayi* Smith.
Wallucina gen. nov.: type *Lucina jacksoniensis* Smith.
Verenulora gen. nov.: type *Lucinida hilaira* Hedley.
Cavatidens gen. nov.: type *Cavatidens omissa* Iredale.
Cavatidens omissa sp. nov.
Epicodakia gunnamatta sp. nov.

Epicodakia consettiana nom. nov.
Bathycorbis gen. nov.: type *Chione despecta* Hedley.
Genaxinus gen. nov.: type *Thyasira albigena* Hedley.
Parathyasira gen. nov.: type *Parathyasira resupina* Iredale.
Parathyasira resupina sp. nov.
Parathyasira resupina neozelanica subsp. nov.
Prothyasira gen. nov.: type *Prothyasira peroniana* Iredale.
Prothyasira peroniana sp. nov.
Prothyasira peroniana peregrina subsp. nov.
Prothyasira adelaideana sp. nov.
Prothyasira benthicola sp. nov.
Virmysella gen. nov.: type *Virmysella spernax* Iredale.
Virmysella spernax sp. nov.
Meridosinia gen. nov.: type *Meridosinia nedigna* Iredale.
Meridosinia nedigna sp. nov.
Sunemeroe gen. nov.: type *Sunetta adelinæ* Angas.
Antigona lamellaris moderata subsp. nov.
Tigammona gen. nov.: type *Tigammona persimilis* Iredale.
Tigammona persimilis sp. nov.
Veremolpa gen. nov.: type *Veremolpa ethica* Iredale.
Veremolpa ethica sp. nov.
Punipagia gen. nov.: type *Tellina subelliptica* Sowerby.
Deltachion gen. nov.: type *Deltachion virilis* Iredale.
Deltachion virilis sp. nov.
Plebidonax gen. nov.: type *Donax deltoides* Lamarck.
Tentidonax gen. nov.: type *Donax veruinus* Hedley.
Deltachion electilis sp. nov.
Austromactra gen. nov.: type *Austromactra caloundra* Iredale.
Nannomactra gen. nov.: type *Mactra jacksonensis* Smith.
Electomactra gen. nov.: type *Mactra parkesiana* Hedley.
Diaphoromactra gen. nov.: type *Hemimactra versicolor* Tate.
Notospisula gen. nov.: type *Gnathodon parvum* Petit.
Austromactra caloundra sp. nov.
Electomactra antecedens sp. nov.
Sponderrilia gen. nov.: type *Errilia australis* Angas.
Amesodesma gen. nov.: type *Amesodesma perfuga* Iredale.
Amesodesma cuneata vanidica subsp. nov.
Amesodesma perfuga sp. nov.
Venatomya gen. nov.: type *Sphænia elliptica* A. Adams.
Benthoquetia gen. nov.: type *Turquetia integra* Hedley.
Notocorbula gen. nov.: type *Notocorbula vicaria* Iredale.
Anisocorbula gen. nov.: type *Corbula macgillivrayi* Smith.
Notocorbula vicaria sp. nov.
Notocorbula hydropica sp. nov.
Notocorbula stolata sp. nov.

MINERALOGICAL NOTES.

No. IV.*

By

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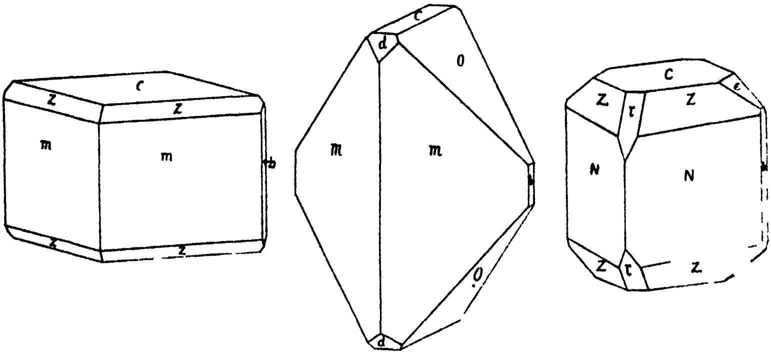
BARITE.

Northmead, near Parramatta, New South Wales.

(Figures 1-3.)

The first record of barite occurring in the Hawkesbury sand stone in the vicinity of Sydney was made by Mr. H. G. Smith[1] in 1891, the locality given being Cook's River, five miles west of Sydney. Since then it has been recorded from Five Dock, Pyrmont, Pennant Hills,[2] Dundas,[3] St. Peters, Macdonaldtown, and Thirlmere.[4]



Figures 1–3.
Barite from Northmead, near Parramatta, New South Wales.
Forms.—c(001), b(010), m(110), N(230), o(011), ε(035), d(102), r(405), z(111), and the new form Z_1(465).

In all these occurrences, with the exception of Dundas, the barite is recorded as being found in the Triassic sedimentary rocks of which the Hawkesbury Sandstone is a part. At Dundas it was found associated with calcite, aragonite, and amethystine quartz in

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* For No. III, see "Records of the Australian Museum," Vol. xv, No. 5, 1927, p. 318.
[1] Smith.—Proc. Linn. Soc. N. S. Wales, (2), vi, 1892, pp. 131-132.
[2] David.—Journ. Roy. Soc. N. S. Wales, xxvii, 1894, p. 407.
[3] Benson.—*Ibid.*, xliv, 1910, p. 501.
[4] Anderson.—Rec. Austr. Mus., vi, 1905, p. 89.

small vughs in the basalt of a volcanic neck which penetrates the Triassic Series. In every case the barite is found well crystallized. In all the specimens that I have examined, the mineral occurs coating the sandstone or shale, having been deposited apparently along crevices and joint planes in the rock. The crystals described in this paper were found in small egg-shaped cavities in a mass of solid sandstone at Pye's Quarry, Northmead, near Parramatta. The cavities are filled with a moist greyish mud, which on drying takes on a pinkish hue, and the crystals are always found embedded in the mud but never attached to the sides of the vughs. Their distribution appears to be somewhat restricted; they are limited in a vertical direction to approximately two metres, though horizontally their extent is considerably greater. They are either oval or spherical in shape, rarely exceeding ten centimetres in diameter, with the longer axis invariably lying in the horizontal plane.

The crystals are colourless and transparent, though they sometimes show a zonal structure, and often have inclusions of the muddy material. They are different in habit from any of the crystals previously described from this formation, and appear to form two definite types. About a hundred crystals were examined and only one was found which did not conform to either of the types. It is prismatic in habit. The prism faces belong to the form N (230), and are well developed, while the brachy-pinacoid is represented by a long narrow face. The crystal is terminated by the basal plane modified by the brachydome τ (405), the rare macrodome ϵ (035), and a new form Z_1 (456). This new form is represented by a full complement of faces, which give fairly good signals. The measured ϕ and ρ angles are 39° 7′ and 63° 45′, and the calculated angles are 39° 16′ and 63° 51′.

TABLE I.

Form.	Measured.		Calculated.		Error.	
	ϕ	ρ	ϕ	ρ	ϕ	ρ
	° ′	° ′	° ′	° ′	′	′
c(001)	—	0 00	—	0 00	0	0
b(010)	0 00	90 00	0 00	90 00	0	0
m(110)	50 52	90 00	50 49	90 00	3	0
N(230)	39 04	90 00	39 16	90 00	12	0
o(011)	0 00	52 46	0 00	52 43	0	3
ϵ(035)	0 07	37 54	0 00	38 15	7	21
d(102)	89 48	38 48	90 00	38 51	2	3
τ(405)	90 00	52 24	90 00	52 13	0	11
z(111)	50 36	64 13	50 49	64 18	13	5
Z_1(465)	39 07	63 45	39 16	63 51	9	6

Type 1.—The largest crystal found of this type measures 6 mm. by 7 mm. by 4 mm. along the three crystallographic axes; more generally they are about half this size. The habit is very simple and the forms m(110) and c(001) are invariably present and well developed and are often modified by narrow faces of the forms b(010) and z(111). This type of crystal is by far the most common of those collected here.

Type 2.—Only a comparatively few crystals of this type were procured. The main difference from the crystals of Type 1 is the development of the brachydome o(011). Occasionally also the macrodome d(102) is developed to a lesser degree.

Professor Sir T. W. Edgeworth David[5] has suggested that the origin of the barite in these Triassic and other sedimentary rocks in New South Wales is due to the decomposition of detrital barytic felspars. In this case it would seem that the barite was due to the precipitation of barium sulphate by the action of sulphate of iron and sulphuric acid set free by the decomposition of pyrite on percolating ground waters containing a soluble barium salt. No pyrite has been found in the mud-filled cavities, but pyritic nodules of similar shape and size are known to exist in these rocks.

STURTITE: A NEW MINERAL.

Broken Hill, New South Wales.

This new mineral was first brought under my notice by Mr. E. M. Holder, and later some very fine specimens were secured from Mr. M. Mawby. It is found in the Zinc Corporation Mine, Broken Hill, New South Wales.

It is amorphous, compact, with a sub-conchoidal to uneven fracture, and is very brittle and friable, breaking up in the fingers with ease. The hardness is slightly over 3, and the streak is yellowish-brown. The lustre is vitreous inclining to greasy. The colour is jet black. The specific gravity is 2·054.

A thin section under the microscope is transparent, pale brown in colour, and isotropic. There is no sign of crystallization.

Before the blowpipe the mineral fuses with difficulty to a black magnetic mass. In the closed tube it gives off abundant water. It is decomposed in acid with the separation of granular silica.

About 4·86 grammes were carefully picked free from impurities and used for analysis. Minute grains of quartz occur intimately associated with the mineral, but these were fairly success-

[5] Anderson.—*Loc. cit.*

fully eliminated as will be seen by the analysis. The results of the analysis, which was very kindly carried out for me by Mr. H. P. White, are shown in Table II.

TABLE II.—Analysis of Sturtite from Broken Hill.

	Weight, per cent.	Molecular weight.	Molecular ratio.	Theoretical weight, per cent. *
SiO_2 free*	0·79			
SiO_2 combined	32·35	0·539	7·92	32·43
Fe_2O_3	10·22	0·068	1·00	10·81
Al_2O_3	0·44			
MnO	25·18			28·79
CaO	2·19	0·405	5·96	
MgO	0·65			
H_2O	28·16	1·565	23·01	27·97
	99·98			100·00

* Including a trace of a silicate mineral

It is important to note that partial analyses by Mr. Mawby and myself substantially agree with the above result, indicating that the mineral is homogeneous in composition.

From the molecular ratios deduced from the analysis it will be seen that the formula may be written thus:

$$Fe_2O_3.\ 6(Mn, Ca, Mg)O.\ 8SiO_2 + 23H_2O.$$

The absence of ferrous iron, and also that of the higher oxides of manganese has been proved, so that, in view of the fact that there is a deficiency of silica, it may be reasonably assumed that the iron is combined with silica and water thus:

$$Fe_2O_3.2SiO_2.3H_2O, \text{ that is } 2[Fe(OH)_3SiO_2]$$

The formula would then be written:

$$2[Fe(OH)_3SiO_2]\ 6\ [(Mn,\ Ca,\ Mg)SiO_3] + 20H_2O, \text{ or}$$
$$Fe(OH)_3SiO_2.3[(Mn,\ Ca,\ Mg)SiO_3] + 10H_2O.$$

However, the iron molecule is not considered to exist as such, and should therefore be combined with the manganese molecule, which reduces the formula to

$$Fe'''(Mn,\ Ca,\ Mg)_3H_8Si_4O_{14} + 10H_2O.$$

The general formula may be written:

$$R'''R''_3H_8Si_4O_{14} + 10H_2O,$$

where R''' = Fe or Al, and R'' = Mn, Ca, or Mg.

It is obvious that this substance is a salt of the hypothetical orthodisilicic acid ($H_6Si_2O_7$) with water in combination. In order to ascertain whether the distribution of water as indicated in the above formula was justified, Mr. White carried out experiments to determine at what temperature the water was driven off. His results are shown in Table III. While the results obtained do not necessarily prove that the distribution of the water is correct, it at least lends very strong support to this assumption, as it will be seen in the last column of the table that 3·38 is the molecular ratio of water driven off at temperatures above 140° C.

TABLE III.—Dehydration of Sturtite.

Temperature ° C.	Per cent. weight of water driven off.	Molecular Weight.	Molecular Ratio.
90–105	23·01	1·278	18·80
105–140	1·02	0·057	0·83
Above 140 ..	4·13	0·230	3·38
	28·16	1·565	23·01

The method used in the above experiments was to weigh the amount of water absorbed by calcium chloride in a U-tube. The powder after the experiment was found to have turned black and increased in weight. On the addition of hydrochloric acid and gently warming, a considerable quantity of chlorine was given off, whereas no chlorine is evolved by the action of acid on the original mineral. Thus on heating the mineral is broken up, and the manganous oxide set free is capable of taking up oxygen to form a higher oxide.

The Australian Museum collection contains about twenty specimens of this mineral, and an examination of these shows that the associated minerals are quartz, amethystine quartz, spessartite, rhodocrosite, calcite, galena, and sphalerite. In a letter from Mr. Mawby, he informs me that rhodonite and manganhedenbergite are also in close association with this mineral. The galena occurs entirely enclosed by sturtite as irregular masses with a perfect cubic cleavage. I have not had the opportunity of visiting the occurrence so that I am unable to give any information on this point.

The name sturtite is proposed for this mineral in honour of the famous explorer Captain Charles Sturt who, as the first white man, visited Broken Hill on the 22nd October, 1844, and, according to Dr. John Harris Browne, secured the first specimens of the great lode itself.

Wolframite.

Mount Bell District, Tasmania.

(Figure 4.)

Among the Museum collection of wolframite is a large crystal from the Shepherd and Murphy mine, twelve miles south-west from Wilmot, in the Mount Bell district, Tasmania. The specimen measures 59 mm. by 35 mm. by 35 mm., and is partly enclosed by

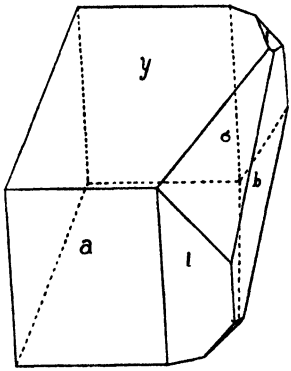


Figure 4.
Wolframite from the Shepherd and Murphy Mine,
Mount Bell district, Tasmania.
Forms.—a(100), b(010), y(102), f(011), and σ(121).

fluorite of pale green colour. According to Mr. W. H. Twelvetrees,[6] other minerals associated with the wolframite of this mine are quartz, calcite, wollastonite, occasionally spodumene, a hydrated mica, and a little topaz.

The angular measurements were made with a contact goniometer, and were sufficiently accurate to determine the forms present, but not good enough to distinguish between the positive and negative forms. However, the forms are either all positive or all negative, and on the measurements of the angle between a and y, it appears to be a fair assumption that they are all positive. The forms present are a(100), b(010), y(102), f(011) and σ(121). Only one face of the clino-pinacoid was visible, the other was covered partly by fluorite and partly represented by cleavage planes.

[6] Tasmanian Secretary for Mines, Report for 1907, p. xi.

EXPLANATION OF PLATE LIX.

Eriphia sebana, var. *smithii* Macleay.

Fig. 1.—Young male from coast at Newcastle, New South Wales. Carapace 22 mm. wide.

Fig. 2.—Ventral view of same, to show sculpture of chelipeds.

Polyonyx transversus (Haswell).

Fig. 3.—Male example from Botany Bay, New South Wales. Carapace 11 mm. wide.

Lissocarcinus polybioides Adams and White.

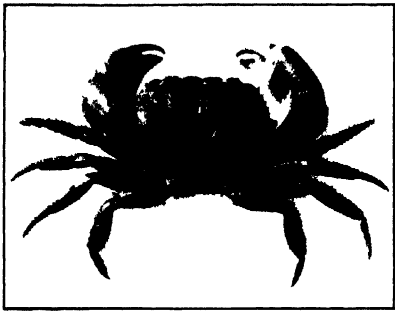
Fig. 4.—Female example from Port Jackson, New South Wales; dredged in 6 fathoms. Carapace 14 mm. wide.

Zalasius dromiæformis (de Haan).

Fig. 5.—Male holotype of *Z. dromiæformis*, var. *australis* Baker. Length 18 mm. (*fide* Baker).

Fig. 6.—Female example, carapace 49 mm. wide, from Queen's Beach, Port Denison, Queensland.

Fig. 7.—Male example (denuded), carapace 42 mm. wide, from same locality.



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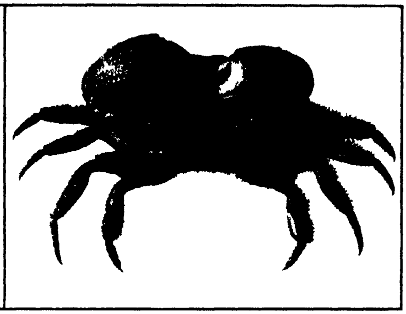

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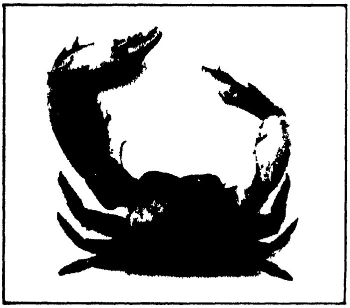

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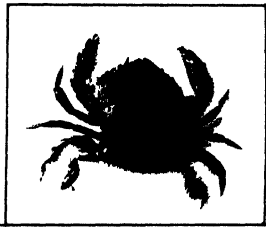

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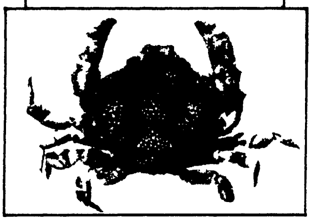

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G. C. CLUTTON, photo.

EXPLANATION OF PLATE LX.

Heterolithadia fallax (Henderson).

Fig. 1.—Male specimen from 11 fathoms, near Michaelmas Reef cay, Great Barrier Reef, off Cairns, Queensland. Carapace 12 mm. wide.

Fig. 2.—Ventral view of same, to show abdomen and sternum.

Ebalia (*Phlyxia*) *ramsayi* Haswell.

Fig. 3.—Female holotype from Port Jackson, New South Wales. Carapace 9 mm. wide.

Fig. 4.—Ventral view of female example from Kurnell, Botany Bay, New South Wales. Carapace 8 mm. wide.

Philyra platycheira de Haan.

Fig. 5.—Dorsal view of male carapace from Port Jackson, New South Wales; dredged in 6 fathoms. Carapace 11 mm. wide.

Fig. 6.—Ventral view of same.

Leucosides hæmatosticta (Adams and White).

Fig. 7.—Male specimen from Port Jackson, New South Wales; 2-3 fathoms (M. Ward collection).

Fig. 8.—Ventral view of same.

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G. C. CLUTTON, photo.

EXPLANATION OF PLATE LXI.

Ebaliopsis erosa (A. Milne Edwards).

Fig. 1.—Female specimen from 11 fathoms, near Michaelmas Reef cay, Great Barrier Reef, off Cairns, Queensland. Carapace 10 mm. wide.

Fig. 2.—Ventral view of same.

Cancer novæ-zealandiæ (Jacquinot and Lucas).

Fig. 3.—Juvenile female specimen from Portobello, Port Chalmers, New Zealand. Carapace 28 mm. wide.

Fig. 4.—Juvenile male specimen from same locality. Carapace 30 mm. wide.

Fig. 5.—Juvenile male specimen from same locality. Carapace 39 mm. wide.

Fig. 6.—Young male specimen from Blueskin Bay, near Port Chalmers, New Zealand. Carapace 52 mm. wide.

Fig. 7.—Adult male specimen from Derwent River, Hobart, Tasmania. Carapace 108 mm. wide.

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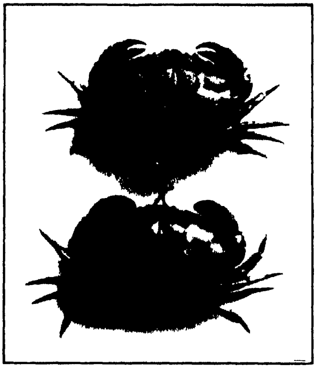

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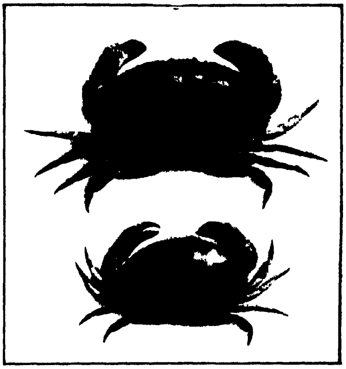

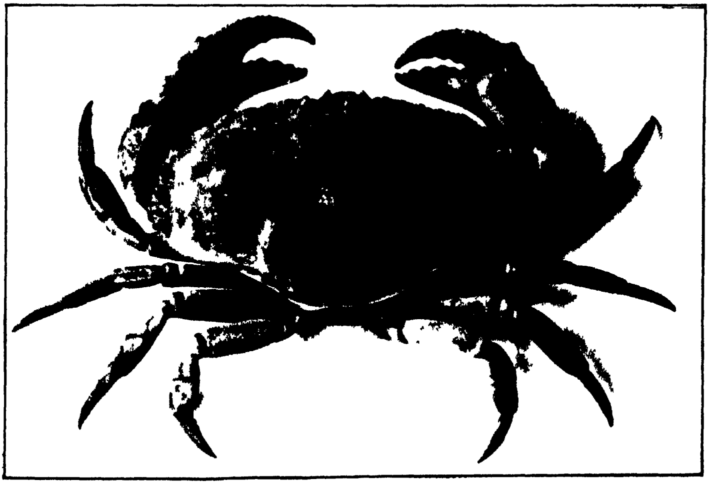

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G. C. CLUTTON, photo.

EXPLANATION OF PLATE LXII.

Fig. 1. *Tigammona persimilis* Iredale, exterior of right valve.

Fig. 2. *Tigammona persimilis* Iredale, interior of right valve.

Fig. 3. *Veremolpa ethica* Iredale, exterior of right valve.

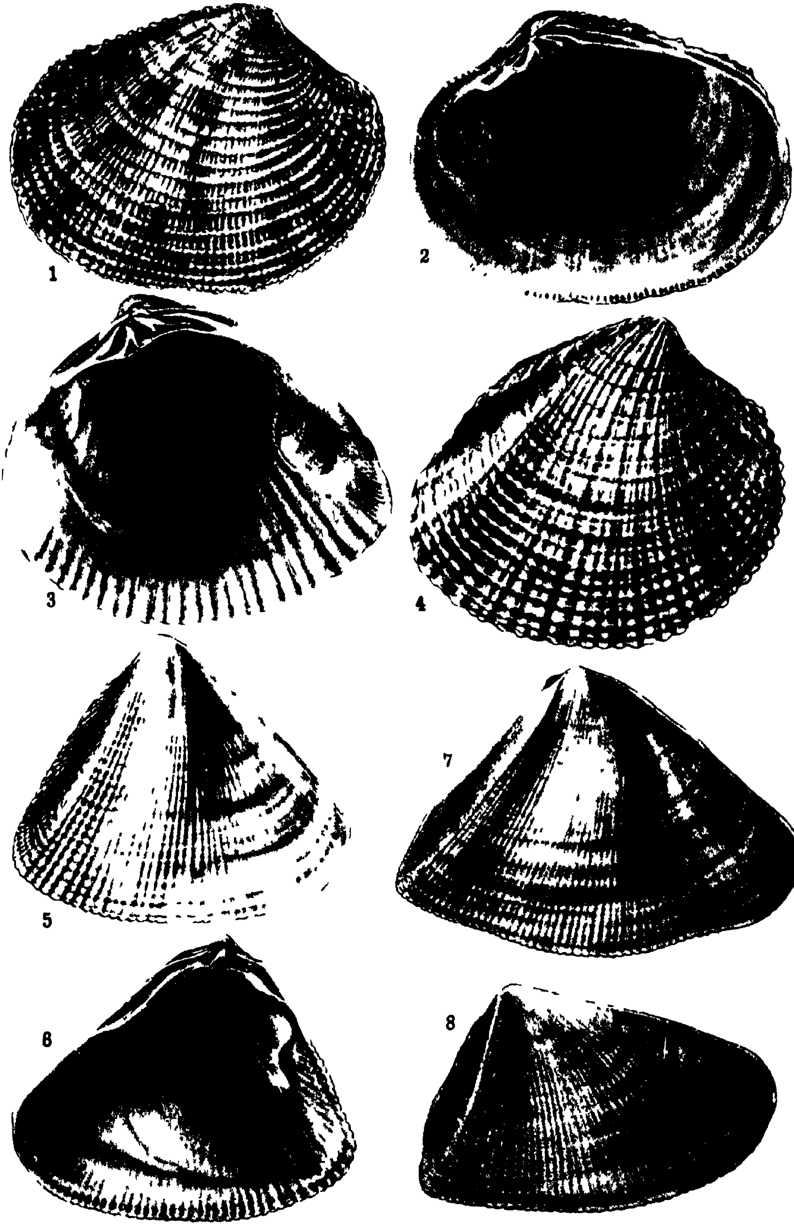
Fig. 4. *Veremolpa ethica* Iredale, interior of right valve.

Fig. 5. *Deltachion virilis* Iredale, exterior of right valve.

Fig. 6. *Deltachion virilis* Iredale, interior of right valve.

Fig. 7. *Deltachion electilis* Iredale, exterior of right valve.

Fig. 8. *Deltachion brazieri* E. A. Smith, exterior of right valve.



Joyce K. Allan, del.

EXPLANATION OF PLATE LXIII.

Fig. 1. *Austromactra caloundra* Iredale, exterior.

Fig. 2. *Austromactra caloundra* Iredale, interior.

Fig. 3. *Cavatidens omissa* Iredale.

Fig. 4. *Cavatidens omissa* Iredale, hinge.

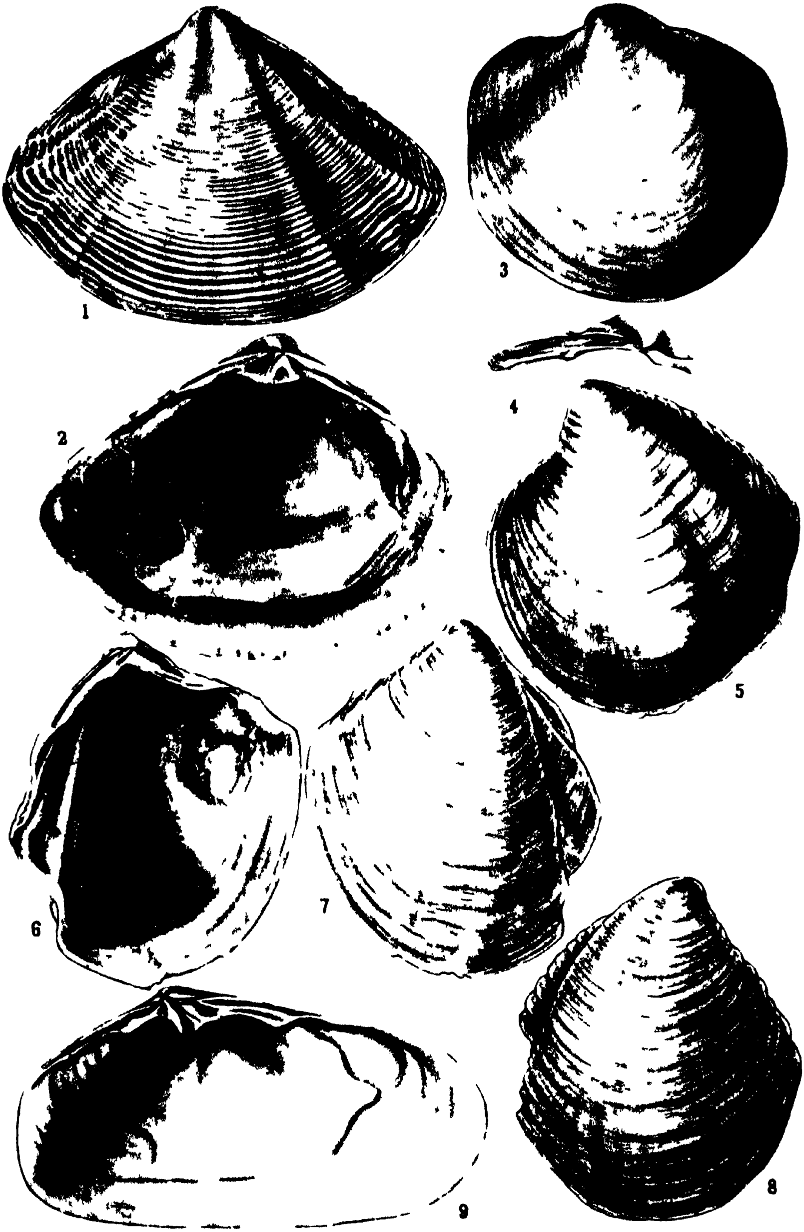
Fig. 5. *Parathyasira resupina* Iredale.

Fig. 6. *Prothyasira adelaideana* Iredale, interior.

Fig. 7. *Prothyasira adelaideana* Iredale, exterior.

Fig. 8. *Prothyasira peroniana* Iredale, exterior.

Fig. 9. *Amesodesma perfuga* Iredale.



JOYCE K. ALLAN, del.

EXPLANATION OF PLATE LXIV.

Fig. 1. *Electomactra antecedens* Iredale, exterior.

Fig. 2. *Electomactra antecedens* Iredale, hinge of left valve.

Fig. 3. *Electomactra antecedens* Iredale, hinge of right valve.

Fig. 4. *Meridosinia nedigna* Iredale, exterior.

Fig. 5. *Meridosinia nedigna* Iredale, interior.

Fig. 6. *Epicodakia gunnamatta*, Iredale, hinge.

Fig. 7. *Epicodakia gunnamatta*, Iredale, exterior of left valve.

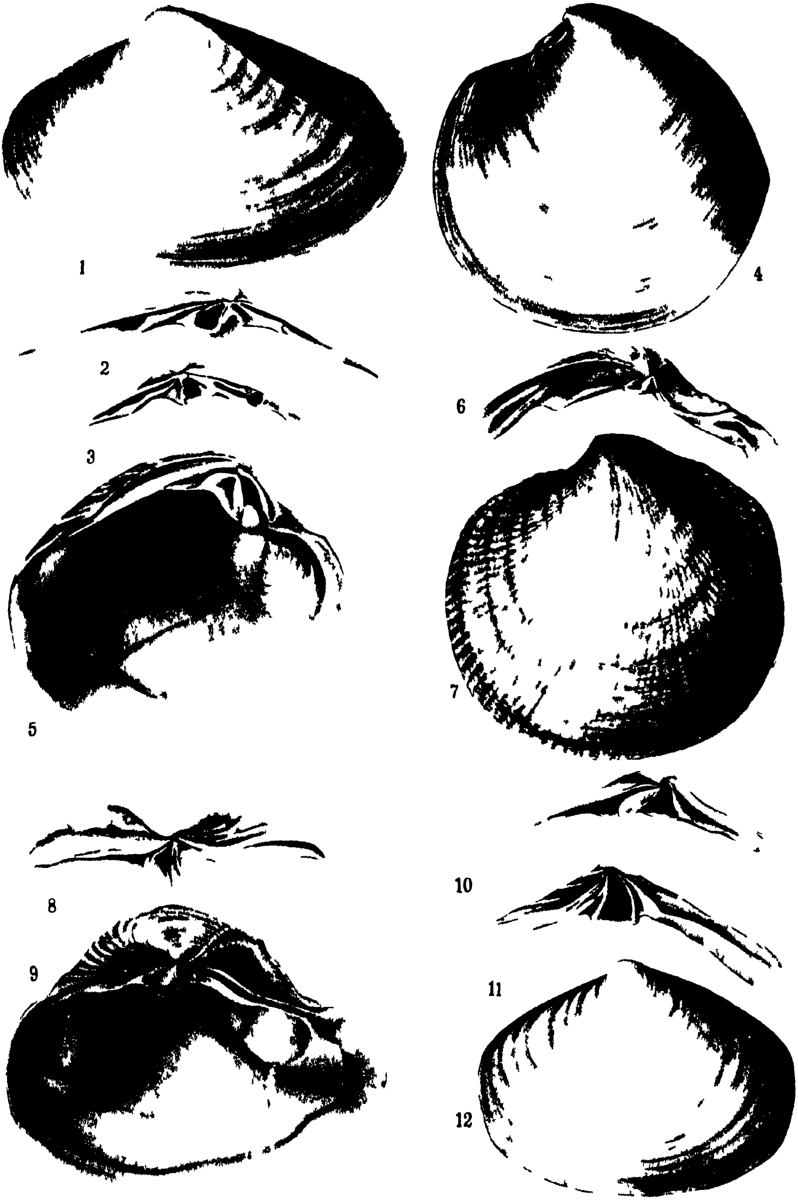
Fig. 8. *Notocorbula vicaria* Iredale, hinge of left valve.

Fig. 9. *Notocorbula vicaria* Iredale, interior of right valve.

Fig. 10. *Virmysella spernax* Iredale, hinge.

Fig. 11. *Virmysella spernax* Iredale, hinge.

Fig. 12. *Virmysella spernax* Iredale, exterior.



JOYCE K. ALLAN del.

EXPLANATION OF PLATE LXV.

Fig. 1. *Notocorbula stolata* Iredale, right valve.

Fig. 2. *Notocorbula stolata* Iredale, left valve.

Fig. 3. *Notocorbula vicaria* Iredale, right valve.

Fig. 4. *Notocorbula vicaria* Iredale, left valve.

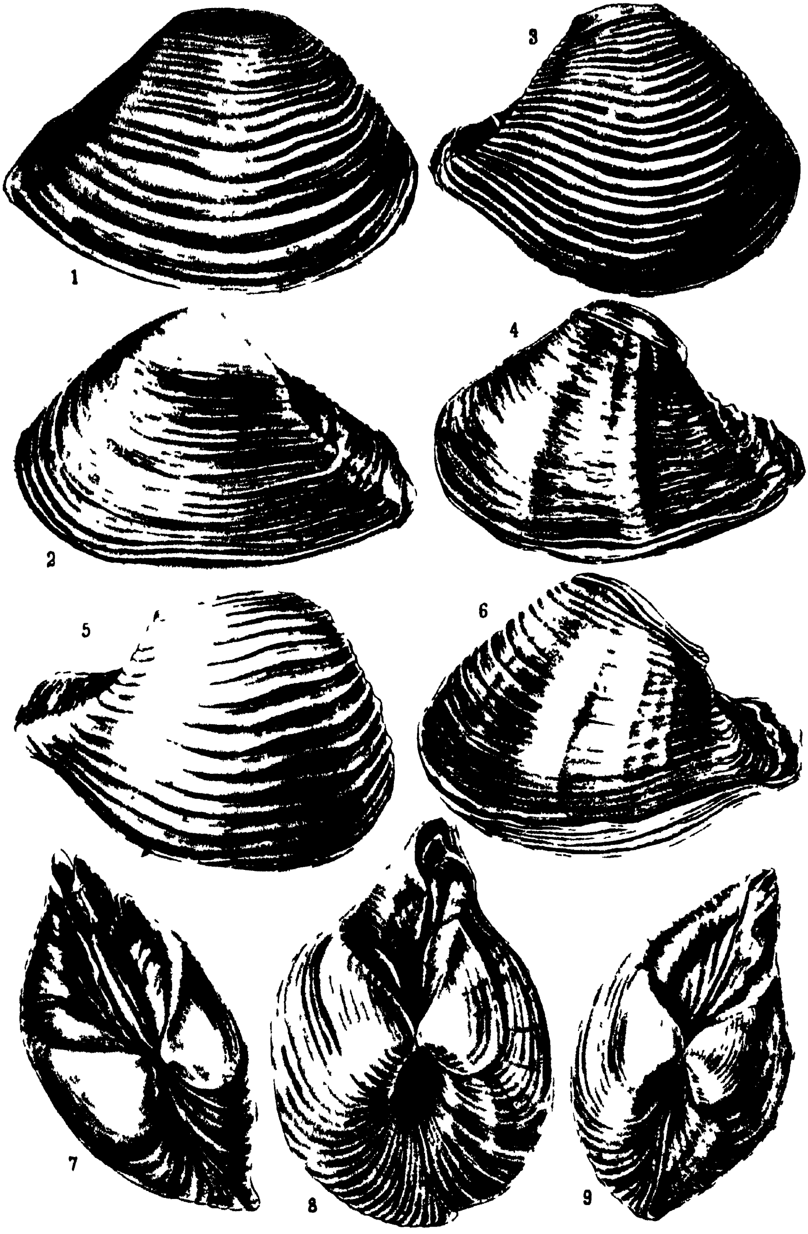
Fig. 5. *Notocorbula hydropica* Iredale, right valve.

Fig. 6. *Notocorbula hydropica* Iredale, left valve.

Fig. 7. *Notocorbula stolata* Iredale, top view of conjoined valves.

Fig. 8. *Notocorbula hydropica* Iredale, top view of conjoined valves.

Fig. 9. *Notocorbula vicaria* Iredale, top view of conjoined valves.



JOYCE K. ALLAN, del.

INDEX.

O

P

U

V